Exhibit A

Race and Redistricting in Texas

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This report contains minor corrections to my initial report filed May 20, 2022. No qualitative or substantive statements are affected by the corrections.

1   Background, qualifications, materials consulted

I am a Professor of Mathematics and a Senior Fellow in the Jonathan M. Tisch College of Civic Life at Tufts University. At Tisch College, I am the principal investigator of an interdisciplinary research lab focused on geometric and computational aspects of redistricting. My areas of research and teaching include the structure of census data and disclosure avoidance systems, the history of the Census, the design and implementation of randomized algorithms for generating districting plans, and the analysis of redistricting more broadly. I was recently awarded a large grant from the National Science Foundation to study *Network Science of Census Data*.

I am compensated at $400/hour for my work in this case. I have previously written reports and provided testimony by deposition, a hearing, or at trial in North Carolina, South Carolina, Pennsylvania, Wisconsin, and Alabama.[1] A full copy of my CV is attached to this report.

1.1   Materials consulted

Materials consulted in the preparation of this report include the following.

- A major source is Census data, primarily the Decennial Census releases (i.e., the PL 94-171). Other data products from the Census Bureau, including the American Community Survey and the TIGER/Line shapefiles, were also used.

- For priorities and criteria, I consulted the Texas Legislature's *Guide to 2021 Redistricting*:
  `redistricting.capitol.texas.gov/docs/guide_to_2021_redistricting.pdf`

- The Texas Legislative Council makes an abundance of resources available on its website (`tlc.texas.gov`), including shapefiles and electoral data.

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[1] *NC League of Conservation Voters, et al. v. Hall, et al.* No. 21-cvs-500085 (Wake Cnty. Sup. Ct. 2021); *Carter v. Chapman*, No. 7 MM 2022, 2022 WL 702894 (Pa. Mar. 9, 2022); *SC NAACP et al. v. Alexander, et al.*, Case No. 3-21-cv-03302-MBS-TJH-RMG (D.S.C.) (three-judge ct.); *Johnson v. Wis. Elections Comm'n*, No. 2021AP1450-OA, 2022 WL 621082 (Wis. Mar. 3, 2022); *Milligan, et al. v. Merrill, et al.*, Case No. 2:21-cv-01530-AMM and *Thomas, et al. v. Merrill, et al.*, Case No. 2:21-cv-01531-AMM (N.D. Ala. 2021).

2 Introduction

The 87th Texas Legislature convened its 3rd Called Session on September 20, 2021. The Legislature ultimately passed four bills in mid-October containing new districting plans:

- H.B. 1, State House Districts (PlanH2316);

- S.B. 4, State Senate Districts (PlanS2168);

- S.B. 6, Texas Congressional Districts (PlanC2193); and

- S.B. 7, State Board of Education Districts (PlanE2106).

They were signed into law by Governor Greg Abbott on Monday, October 25.

Texas (population 29,545,105) is to be divided into 38 Congressional, 31 state Senate, and 150 state House districts, respectively; this means that ideal populations for each type of district, rounded to the nearest integer, are:

777,503 (Congress);   953,068 (Senate);   and   196,967 (House).

I have been asked to study the enacted Congressional, Senate, and House maps, and to put them in context of demographics and electoral conditions in their regions of the state, so as to see whether and to what extent the evidence supports a VRA Section 2 challenge and/or a constitutional challenge that examines an overlapping but not identical set of districts. I have localized my VRA inquiry to five areas of the state made up by counties or county pairs: Dallas/Tarrant; Harris/Fort Bend; Denton/Wise; Lubbock; and Brazoria. Below, I will present evidence that bears on the cohesion of Black, Hispanic/Latino, and Asian American/Pacific Islander (AAPI) groups as an electoral coalition. I will refer to this combined population as the POC ("people of color") coalition, or simply the **coalition**, for short.

I will discuss the following seven district clusters, depicted in Figure 1.

C1. CD-Tarrant/Dallas – seven districts from the state's Congressional plan (CD 6, 12, 24, 25, 30, 32, and 33)

C2. CD-Harris/FtBend – eight districts from the state's Congressional plan (CD 2, 7, 9, 14, 18, 22, 29, and 38)

S1. SD-Tarrant/Dallas – 7 districts from the state's Senate plan (SD 9, 10, 12, 16, 22, 23, and 30)

S2. SD-FtBend – 5 districts from the state's Senate plan (SD 6, 13, 15, 17, and 18)

H1. HD-Tarrant – 11 districts from the state's House plan (HD 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, and 101)

H2. HD-Dallas – 14 districts from the state's House plan (HD 100, 102, 103, 104, 105, 107, 108, 109, 110, 111, 112, 113, 114, 115)

H3. HD-Denton/Wise – 5 districts from the state's House plan (HD 57, 63, 64, 65, and 106)

H4. HD-Lubbock – 2 districts from the state's House plan (HD 83 and 84)

H5. HD-Brazoria – 2 districts from the state's House plan (HD 25 and 29).
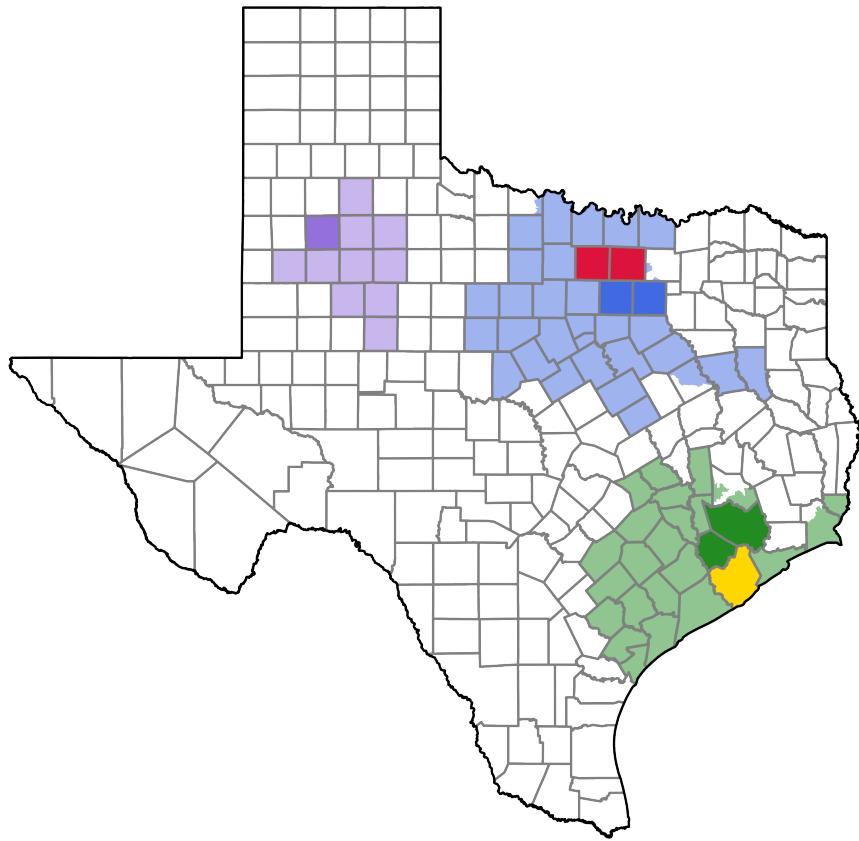
Figure 1: The counties that anchor the district clusters discussed below are highlighted-din this figure : Tarrant and Dallas (blue), Wise and Denton (red), Harris and Fort Bend (green), Brazoria (yellow), and Lubbock (purple). The districts that start in those highlighted counties extend over much of the land area of Texas, as shown here.

My assignment includes the following three major components.

- **Gingles 1**: In each cluster, demonstrate whether the POC coalition is sufficiently numerous and geographically compact to constitute a majority of citizen voting age population (CVAP) in at least one district more than is found in the state's corresponding plan.

- **Gingles 2/3**: In the counties covered by the complaint, assess how the voting patterns break down by voter race and ethnicity. Consider whether a racially polarized voting analysis lends support to a claim that Black, Hispanic/Latino, and Asian American/Pacific Islander (AAPI) groups vote cohesively as a coalition bloc, and the complementary majority population votes sufficiently as a bloc to prevent the coalition from electing candidates of choice.

- **Racial gerrymandering**: Provide a close examination of the decisions that went into line-drawing in the state's plans. Examine adherence to traditional districting principles and to recognized legitimate aims of redistricting. Investigate the pos-

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sibility that race-neutral criteria were subordinated to excessively race-conscious boundaries; investigate the evidence of intent to dilute the vote of the minority coalition.

The racial gerrymandering inquiry will consider numerous districts from the clusters above, as well as seven additional House districts (HD 26, 54, 66, 67, 121, 126, and 132).

3   Rules and priorities for Texas redistricting

The *Guide to 2021 Redistricting* published by the Texas Legislative Council discusses the requirements, the process, the data, and the venues for public participation in the Legislature-run redistricting process.

There are few state-specific rules for redistricting outlined in the Guide. First, the document reviews the federal requirements for population balance and for protections on the basis of race, ethnicity, and language. For population balance, the Guide cites the national standard that legislative districts should normally be within 5% of ideal district population, noting a conventional "stricter" standard for Congressional districts. In voting rights terms, the Guide asserts that "districts must be drawn in a manner that neither has the purpose nor will have the effect of denying or abridging the right to vote on the basis of race, color, or language group."

There are only two other specifications of traditional districting criteria cited in the Guide. First, there is a requirement that state Senate districts be composed of contiguous territory, i.e., that each district should be a single connected piece. (Notably, this is not mentioned for Congressional or state House districts.) Next, a "county line rule" is articulated—only for state House districts—which is quite strict if applied literally.

Quoting directly, the Guide says:

(1) a county with sufficient population for exactly one district must be formed into a single district;
(2) a county with a population smaller than the population needed for a whole district must be kept whole and combined with one or more contiguous counties to form a district;
(3) a county that has sufficient population for two or more whole districts must be divided into that number of districts, with no district extending into another county; and
(4) each county with a population sufficient for one or more whole districts plus a fraction of another district must be divided into that many whole districts, with the excess population added to one or more contiguous counties to form an additional district.

The only exceptions envisioned to this rule are those that are necessitated by the ±5% limit on population deviation in the plan as a whole.

Beyond these criteria, the rest of the Guide is devoted to issues of procedure and timing. In particular, there is no mention of several widely invoked districting criteria: district compactness, incumbent protection, or the preservation of district cores. Respect for communities of interest is only cited as a topic for public hearings that "the legislature may consider relevant." Issues of partisan bias and the use of partisan data are not discussed at all.

4 Demographics

Texas, long one of the most populous and most diverse states in the nation, continues to rapidly grow and diversify. The 2020 Decennial Census saw its population rise to 29,145,505 from a total of 25,145,561 ten years prior; this nearly sixteen percent growth made it the only state whose apportionment increased by two seats in the House of Representatives. In the new data release, non-Hispanic White residents fell to 43.2% of the voting age population; only New Mexico, California, and Hawaii have a lower share.

Texas has four cities with over one million residents—Houston, San Antonio, Dallas, and Austin—putting all four in the top ten nationally (4th, 7th, 9th, and 10th, respectively). All four are growing at a rapid clip, having added 6-10 percent of their 2010 population since the last census. Another city, Fort Worth, is nearing the million mark, with an even larger jump of 24% in ten years.

Texans are remarkably diverse in terms of race, ethnicity, language, and origin. Black, Latino, and Asian American/Pacific Islander (henceforth abbreviated AAPI or simply Asian) groups are all large and prominent in state politics. Many Texan cities, and urban counties, showcase the same diversity as the state as a whole. Of the counties examined below, Dallas, Fort Bend, and Harris are all over 20% Black by population; Dallas, Harris, Lubbock, and Brazoria are all over 30% Latino by population. The Houston and Dallas metro areas are two of the most heavily Asian metros by population share of any in the United States today—both in the top twenty nationally—and Fort Bend County is over 20% Asian by population.

Below, we will see that the Black-Latino-Asian coalition of Texan residents votes extremely cohesively (§6); together, this coalition makes up over 58% of the population and over 48% of the citizen voting age population of the state.

Statewide demographics break down as follows.[2]

	Total Population		VAP 2020		CVAP 5-year	
Black	3,964,700	(13.6%)	2,837,841	(12.98%)	2,512,354	(13.52%)
Hispanic	11,204,738	(38.44%)	7,794,168	(35.64%)	5,671,688	(30.53%)
Asian	1,744,974	(5.99%)	1,308,044	(5.98%)	783,386	(4.22%)
Coalition	16,914,412	(58.03%)	11,940,053	(54.6%)	8,967,428	(48.27%)
White	11,584,597	(39.75%)	9,437,993	(43.16%)	9,428,872	(50.75%)
Total	29,145,505		21,866,700		18,578,760	

Table 1: Demographics of Texas

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[2]Wherever possible, I use *Black* to denote Black racial categories alone or in combination; *Hispanic/Latino* for all respondents indicating Hispanic ethnicity, except those already counted as Black; *Asian* (or more fully AAPI) for all residents with Asian American/Pacific Islander responses, except those already counted as Black or Hispanic; and *White* for non-Hispanic White alone. The remainder of Texans, denoted "Other" below, are over 98% identified as White alone, but also include those who responded as Native American or Some Other Race. The American Community Survey does not offer the same range of racial identification options as the Decennial Census, so the race categories available there are considerably simplified. See Appendix A for more details. For this reason and because the data products are collected with a different methodology and over a different time period, the White citizen voting age population (CVAP) in a given locality according to the ACS may exceed the White voting age population (VAP) reported in the Decennial Census. I also note that the CVAP totals presented below are summed over the block groups in each locality; this may give a slightly different result from the county total reported by the ACS, for reasons internal to the Bureau's methodology. I have chosen to report this block-group sum because these are the data that will be used in assessing the districts below.

4.1 Tarrant and Dallas Counties

Dallas County is home to the City of Dallas, whose population sits at over 1.3 million. Several other cities have more than 150,000 residents: Garland, Irving, Mesquite, and Grand Prairie (which straddles the Dallas-Tarrant county line). There are two major cities anchoring Tarrant County: Fort Worth (population 927,720) and Arlington (population 394,266).

	Total Population		VAP 2020		CVAP 5-year	
Black	404,404	(19.16%)	281,397	(17.88%)	238,870	(17.64%)
Hispanic	603,106	(28.57%)	405,913	(25.79%)	273,325	(20.18%)
Asian	143,992	(6.82%)	107,712	(6.84%)	70,489	(5.2%)
Coalition	1,151,502	(54.56%)	795,022	(50.51%)	582,684	(43.02%)
White	904,884	(42.87%)	738,298	(46.9%)	756,271	(55.84%)
Total	2,110,640		1,574,046		1,354,445	

Table 2: Demographics of Tarrant County

	Total Population		VAP 2020		CVAP 5-year	
Black	611,735	(23.41%)	452,877	(22.96%)	426,840	(27.81%)
Hispanic	1,037,954	(39.71%)	712,636	(36.13%)	383,502	(24.99%)
Asian	195,100	(7.46%)	149,921	(7.6%)	84,195	(5.49%)
Coalition	1,844,789	(70.59%)	1,315,434	(66.69%)	894,537	(58.28%)
White	724,987	(27.74%)	622,696	(31.57%)	625,099	(40.73%)
Total	2,613,539		1,972,578		1,534,845	

Table 3: Demographics of Dallas County

Tarrant County
CVAP

Dallas County
CVAP

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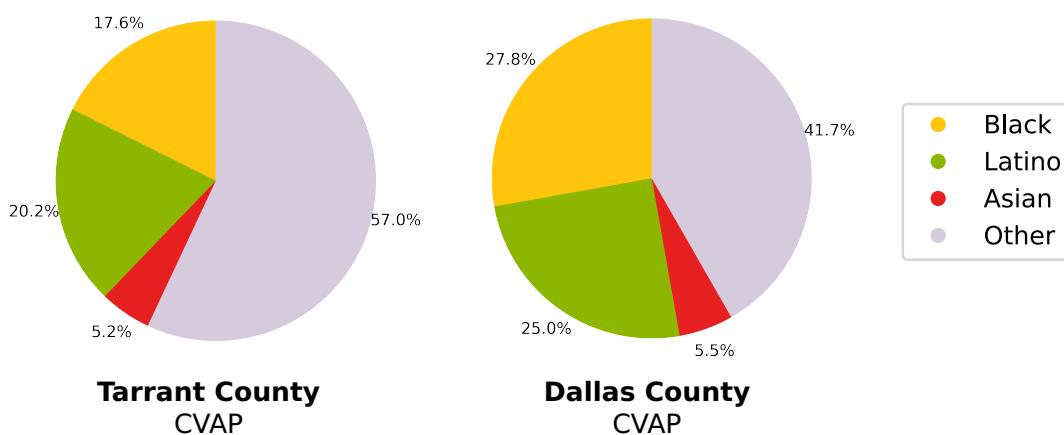
4.2   Harris and Fort Bend Counties

Harris is the third largest county in the nation after Los Angeles, CA and Cook, IL. Fort Bend County has a very large Asian population—over 23% of the total population, and over 18% by citizen voting age population—making it the highest AAPI share in any Texas county, and one of the highest in the country. Fort Bend is home to Sugar Land, its largest city and one of the most explosively growing cities in the nation, which saw a jump of +40.87% since the last census. Today, more than four in ten residents of Sugar Land is Asian-identified.

	Total Population		VAP 2020		CVAP 5-year	
Black	981,484	(20.75%)	712,166	(20.23%)	626,025	(22.68%)
Hispanic	1,985,784	(41.97%)	1,379,234	(39.19%)	855,340	(30.99%)
Asian	374,196	(7.91%)	293,222	(8.33%)	192,104	(6.96%)
Coalition	3,341,464	(70.63%)	2,384,622	(67.75%)	1,673,469	(60.63%)
White	1,309,593	(27.68%)	1,075,663	(30.56%)	1,064,539	(38.57%)
Total	4,731,145		3,519,584		2,760,070	

Table 4: Demographics of Harris County

	Total Population		VAP 2020		CVAP 5-year	
Black	183,786	(22.34%)	129,868	(21.75%)	112,102	(23.08%)
Hispanic	191,699	(23.3%)	132,154	(22.14%)	97,358	(20.04%)
Asian	190,051	(23.1%)	138,433	(23.19%)	88,613	(18.24%)
Coalition	565,536	(68.73%)	400,455	(67.08%)	298,073	(61.36%)
White	243,726	(29.62%)	187,278	(31.37%)	184,586	(38.0%)
Total	822,779		596,993		485,810	

Table 5: Demographics of Fort Bend County

Harris County
CVAP

Fort Bend County
CVAP

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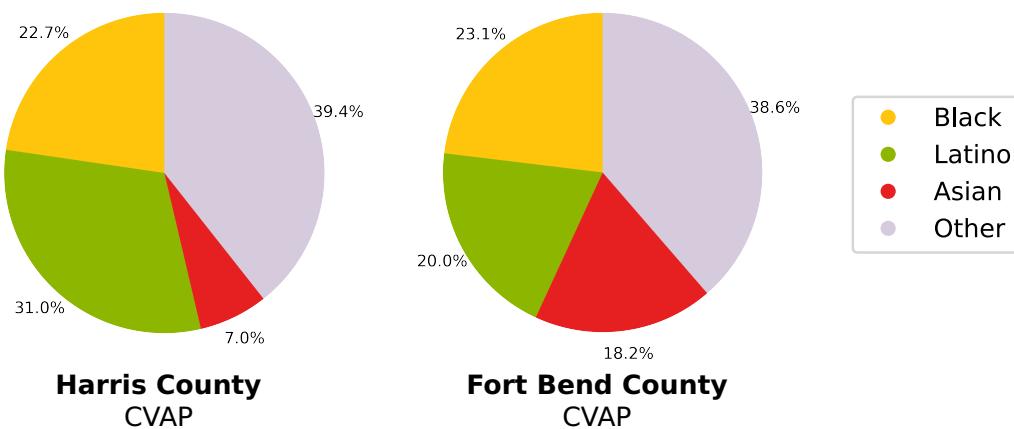
4.3 Denton and Wise Counties

Wise County is small (68,632) and relatively Whiter than the other counties on this list, with White CVAP at nearly 85%. Neighboring Denton County has three cities over 100,000 (Denton, Carrollton, and Lewisville) and contains part of Frisco. Carrollton and Lewisville sit together in the southeastern corner of the county and formed the heart of a House district (HD 65) in the benchmark plan. In each of those cities, coalition population makes up more than six in ten residents.

	Total Population		VAP 2020		CVAP 5-year	
Black	113,638	(12.54%)	79,448	(11.71%)	64,761	(11.09%)
Hispanic	176,820	(19.51%)	119,938	(17.68%)	82,080	(14.05%)
Asian	102,549	(11.31%)	73,199	(10.79%)	41,012	(7.02%)
Coalition	393,007	(43.36%)	272,585	(40.18%)	187,853	(32.16%)
White	485,646	(53.58%)	385,461	(56.82%)	389,440	(66.68%)
Total	906,422		678,416		584,050	

Table 6: Demographics of Denton County

	Total Population		VAP 2020		CVAP 5-year	
Black	1261	(1.84%)	768	(1.48%)	727	(1.53%)
Hispanic	13,506	(19.68%)	8714	(16.81%)	5350	(11.24%)
Asian	569	(0.83%)	387	(0.75%)	324	(0.68%)
Coalition	15,336	(22.35%)	9869	(19.04%)	6401	(13.45%)
White	50,495	(73.57%)	39,787	(76.76%)	40,405	(84.91%)
Total	68,632		51,836		47,585	

Table 7: Demographics of Wise County

Denton County
CVAP

Wise County
CVAP

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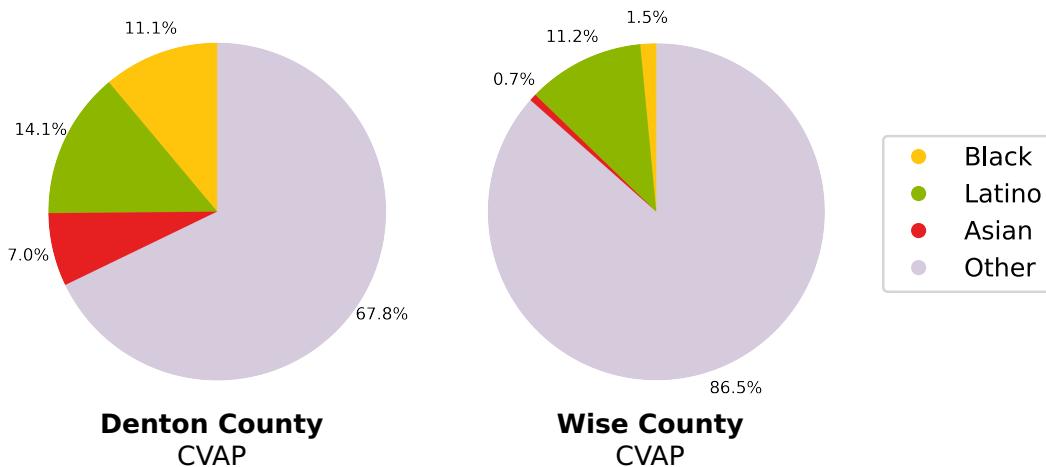
4.4 Lubbock County

Lubbock County, a mid-sized county in the lower Texas Panhandle, is nearly exactly half White by population, and over one-third Latino. Shifting to citizen voting age population shifts those numbers as seen below.

The only major city is Lubbock, with population 257,141, after which the cities drop off rapidly in size to below 6000. This means that the City of Lubbock has nearly 83% of the county's residents, and is the size of 1.3 House districts.

	Total Population		VAP 2020		CVAP 5-year	
Black	31,107	(10.01%)	22,065	(9.29%)	15,526	(6.95%)
Hispanic	106,222	(34.19%)	73,877	(31.1%)	69,360	(31.06%)
Asian	10,765	(3.47%)	8807	(3.71%)	3663	(1.64%)
Coalition	148,094	(47.67%)	104,749	(44.1%)	88,549	(39.66%)
White	154,994	(49.9%)	126,770	(53.37%)	132,885	(59.51%)
Total	310,639		237,542		223,295	

Table 8: Demographics of Lubbock County


Lubbock County
CVAP
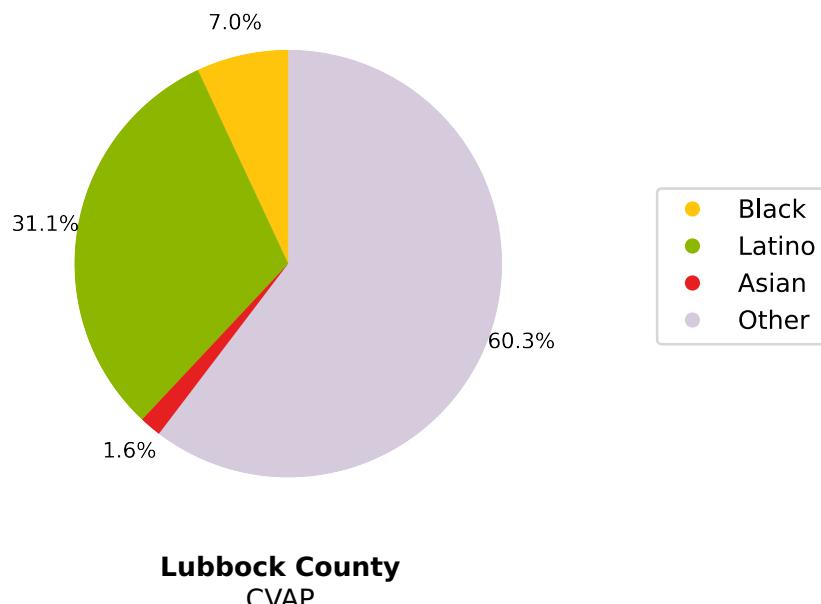
4.5 Brazoria County

Brazoria is a medium-sized county on the Gulf Coast. Pearland is its largest city, at a population of 125,828, and no other city breaks 30,000. Together, Black, Latino, and Asian residents make up nearly half of the citizen voting age population.

	Total Population		VAP 2020		CVAP 5-year	
Black	61,118	(16.43%)	43,332	(15.71%)	39,145	(15.69%)
Hispanic	111,908	(30.08%)	76,303	(27.66%)	62,807	(25.17%)
Asian	28,562	(7.68%)	20,451	(7.41%)	13,911	(5.57%)
Coalition	201,588	(54.19%)	140,086	(50.77%)	115,863	(46.43%)
White	161,833	(43.5%)	129,282	(46.86%)	131,590	(52.73%)
Total	372,031		275,900		249,555	

Table 9: Demographics of Brazoria County

Brazoria County
CVAP
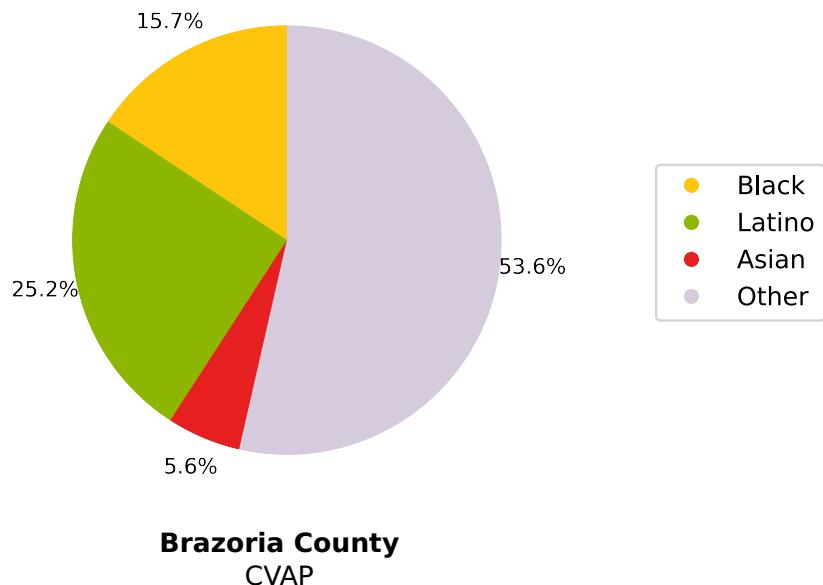
5 Demonstrative plans for Gingles 1

The first Gingles factor in VRA enforcement, serving as a precondition for Section 2 litigation, asks for a demonstration that the racial or language minority group discussed in the claim is "sufficiently large and geographically compact to constitute a majority in a single-member district." To satisfy this threshold test, I will provide alternative maps containing reasonably compact districts with an additional district meeting the 50% CVAP threshold for the proposed coalition of Black, Hispanic, and Asian residents. In many cases, there will also be an additional district that crosses the 50% line for an individual minority racial group.

In these county clusters, the enacted plans already possess some districts that are majority-coalition by CVAP. In each case, these are retained, while adding **an additional majority-coalition district** within a plan that has **comparable or greater compactness** than the state's enacted plan in that area (serving to ensure that the minority population is itself compact, as required).[3] Importantly, the alternative plan in each cluster **covers precisely the same terrain** as the corresponding districts that are grouped from the state's plan. That means that these alternatives can be independently adopted in a self-contained manner, without ripple effects cascading through the rest of the state.

I emphasize that these proposed plans are intended as *Gingles 1 demonstration plans*; that is, they are designed to prove that the coalition of Black+Hispanic+Asian minority groups meets the numerosity and compactness requirement to allow for an additional majority-coalition district (at least 50%+1-person coalition population by CVAP), while maintaining or improving on adherence to traditional districting principles. If liability is established, it is my understanding that different configurations of districts may be solicited and proposed by the Legislature and the parties at the remedial phase. Once the 50% CVAP threshold no longer plays a central role, the focus can turn to assessing effective opportunity through a performance analysis and a more fine-grained look at recent voting trends. Among other things, remedial plans might focus on whether more majority-HCVAP and/or more Latino opportunity districts would be in play without race or ethnicity as a primary consideration in the drawing.

In the meantime, for the purposes of this Gingles 1 exercise, my preliminary performance analysis has confirmed that a 50% coalition CVAP (and likewise 50% BCVAP and 50% HCVAP) generally has a high likelihood of securing electoral opportunity for minority candidates of choice in each county cluster discussed below—though not necessarily in all regions of the state.

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[3]The criterion of district *compactness* is the principle that districts should be reasonably shaped, not eccentric or irregular. Compactness is also sometimes used to describe population distributions rather than districts; in that usage, compact populations are those that are clustered rather than dispersed. By far the most common compactness metric in redistricting literature and practice is the so-called *Polsby-Popper score*. This is a contour-based score that relies on the outline of the district on a map, formed by comparing the district's area to its perimeter via the formula $4\pi A/P^2$. Higher Polsby-Popper scores are considered better; this standard idealizes a perfectly round district, since circles are the only shapes that realize the maximum score of 1. What constitutes a "good" Polsby-Popper score varies considerably from state to state based on physical and human geography and traditional redistricting decisions in that state. Texas is frequently home to some of the least compact districts in the country, and in this set of enacted plans, the state has put forward some remarkably non-compact districts, with scores as low as 4% of ideal (e.g., CD 33).

5.1   Congressional districts in Tarrant/Dallas (C1)

First we consider the 7-district Congressional cluster C1 in Tarrant/Dallas. The alternative plan presented here has an additional majority-coalition district (CD 12) with a signficant HCVAP percentage, an additional majority-Black district (CD 30), and is substantially more compact than the state's plan. In the alternative plan, CD 33 is fully located in Tarrant County, and CD 12, whose significant HCVAP accounts for Latino population growth in the region, is highly compact and mostly falls in Dallas County.

   This is just one of many possibilities for illustrating additional majority-coalition districts; other alternative maps can form CD 12 as a majority-HCVAP district.

CD	C2193					Alternative plan				
	Black CVAP	Hisp CVAP	AAPI CVAP	BHA CVAP	Polsby Popper	Black CVAP	Hisp CVAP	AAPI CVAP	BHA CVAP	Polsby Popper
6	15.37%	21.28%	2.98%	39.64%	0.154	11.01%	15.51%	1.55%	28.06%	0.18
12	10.71%	17.62%	3.36%	31.69%	0.208	20.64%	40.02%	5.23%	65.89%	0.371
24	7.05%	11.83%	6.61%	25.49%	0.114	9.26%	11.85%	7.44%	28.55%	0.154
25	11.68%	15.15%	2.84%	29.67%	0.259	4.82%	12.43%	2.63%	19.88%	0.333
30	48.81%	21.31%	3.48%	73.59%	0.197	52.78%	18.04%	4.16%	74.98%	0.189
32	23.83%	21.10%	7.18%	52.10%	0.077	24.22%	24.0%	6.25%	54.48%	0.113
33	26.82%	43.19%	4.72%	74.73%	0.038	21.21%	29.35%	4.20%	54.76%	0.083
Avg					0.149					0.203

Table 10: Demographic and compactness comparison between plans.
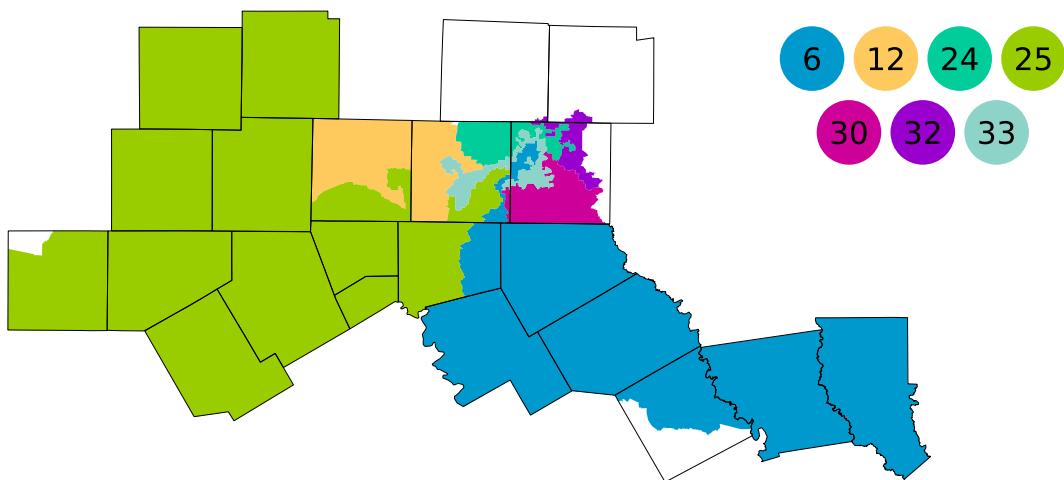
Figure 2: The enacted Tarrant/Dallas districts needlessly sprawl over 20 counties.
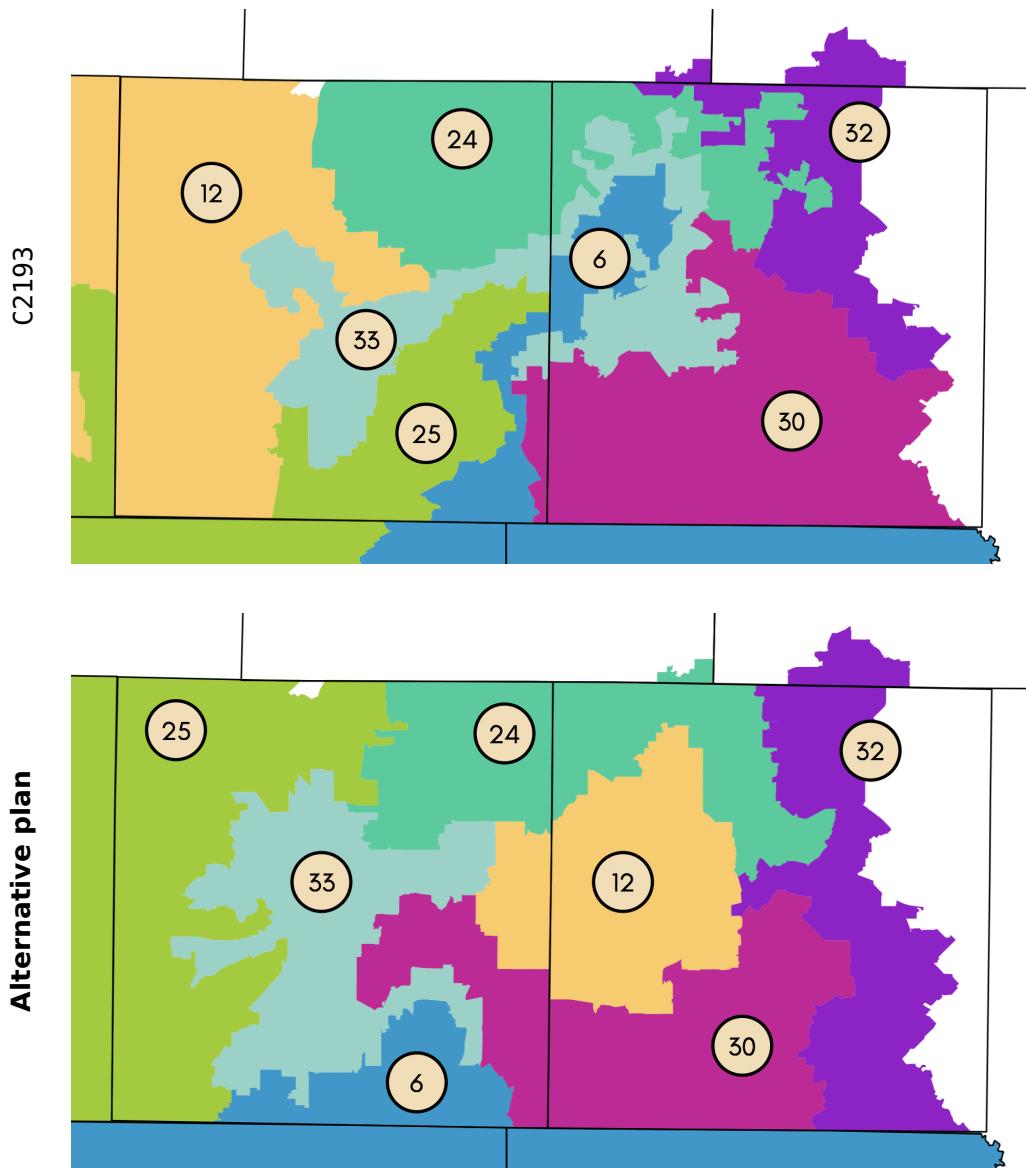
Figure 3: A close-up view of how Congressional districts meet Tarrant and Dallas Counties in the state's plan (top) and the alternative plan (bottom).

5.2 Congressional districts in Harris/Fort Bend (C2)

Next, we move to the 8-district Congressional cluster C2 in Harris and Fort Bend Counties. The alternative plan adds a new majority-coalition district (CD 2), retains a majority-Hispanic district (CD 29), and adds a majority-Black district (CD 9), while substantially improving compactness overall. As before, this is just one of many possible configurations that meet the Gingles 1 threshold; other possibilities could draw an additional majority-HCVAP district.

	C2193					Alternative plan				
CD	Black CVAP	Hisp CVAP	AAPI CVAP	BHA CVAP	Polsby Popper	Black CVAP	Hisp CVAP	AAPI CVAP	BHA CVAP	Polsby Popper
2	11.50%	20.05%	3.53%	35.09%	0.228	27.07%	27.54%	2.22%	56.83%	0.248
7	20.39%	21.15%	18.66%	60.21%	0.092	17.61%	24.26%	18.13%	59.99%	0.306
9	47.22%	24.76%	8.49%	80.46%	0.164	51.13%	21.91%	8.35%	81.39%	0.206
14	17.17%	17.78%	2.50%	37.44%	0.161	17.48%	17.79%	3.15%	38.42%	0.157
18	40.71%	29.05%	5.32%	75.08%	0.068	28.68%	29.71%	6.59%	64.98%	0.192
22	11.71%	23.74%	10.65%	46.09%	0.164	13.64%	21.35%	9.49%	44.47%	0.121
29	17.95%	64.65%	3.02%	85.62%	0.092	9.35%	52.88%	4.63%	66.86%	0.122
38	10.38%	18.62%	8.62%	37.62%	0.125	10.22%	19.55%	7.83%	37.61%	0.121
Avg					0.137					0.184

Table 11: Demographic and compactness comparison between plans.
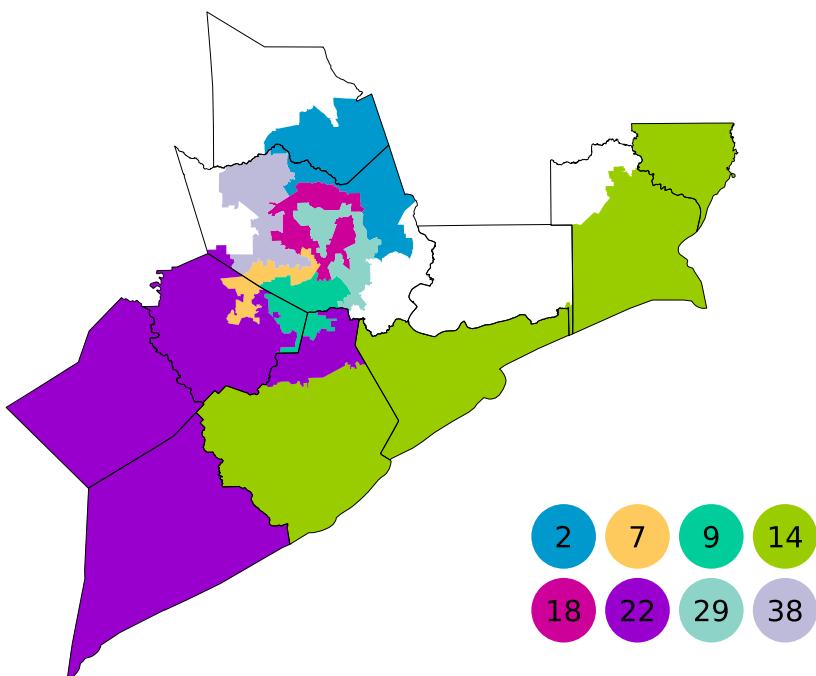
Figure 4: In the state's plan, several districts stretch to distant rural counties.

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C2193
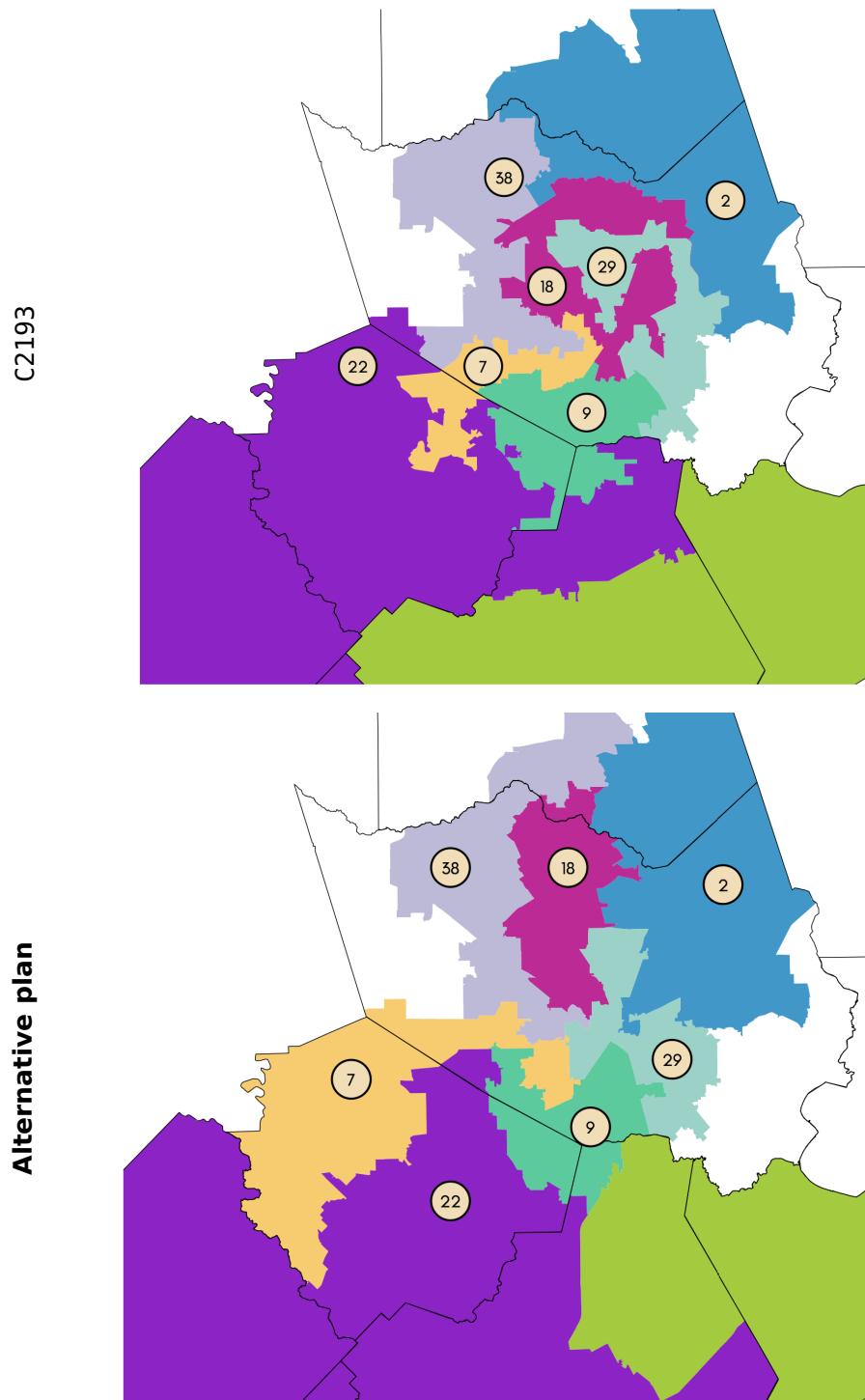
Alternative plan

Figure 5: A close-up view of how Congressional districts meet Harris and Fort Bend Counties in the state's plan (top) and the alternative plan (bottom).

5.3 Senate districts in Tarrant/Dallas (S1)

Next, we move to the 7-district Senate cluster S1 in Tarrant/Dallas. The alternative plan has an additional majority-coalition district (SD 10) as well as increasing the BCVAP to a majority in SD 23. Compactness is comparable in the alternative plan.

SD	S2168					Alternative plan				
	Black CVAP	Hisp CVAP	AAPI CVAP	BHA CVAP	Polsby Popper	Black CVAP	Hisp CVAP	AAPI CVAP	BHA CVAP	Polsby Popper
9	9.75%	20.54%	4.71%	35.00%	0.206	8.35%	14.43%	4.69%	27.46%	0.139
10	17.13%	18.55%	2.42%	38.10%	0.152	23.31%	26.28%	6.54%	56.13%	0.082
12	9.16%	13.64%	7.61%	30.41%	0.222	14.04%	13.51%	7.78%	35.32%	0.162
16	20.71%	30.15%	4.78%	55.64%	0.086	16.65%	37.77%	3.64%	58.06%	0.093
22	15.49%	17.45%	3.46%	36.39%	0.228	8.21%	15.29%	1.00%	24.50%	0.291
23	45.46%	24.69%	3.31%	73.47%	0.192	51.83%	21.04%	3.46%	76.33%	0.109
30	9.13%	12.27%	4.95%	26.34%	0.140	8.43%	11.86%	4.41%	24.71%	0.244
Avg					0.175					0.160

Table 12: Demographic and compactness comparison between plans.
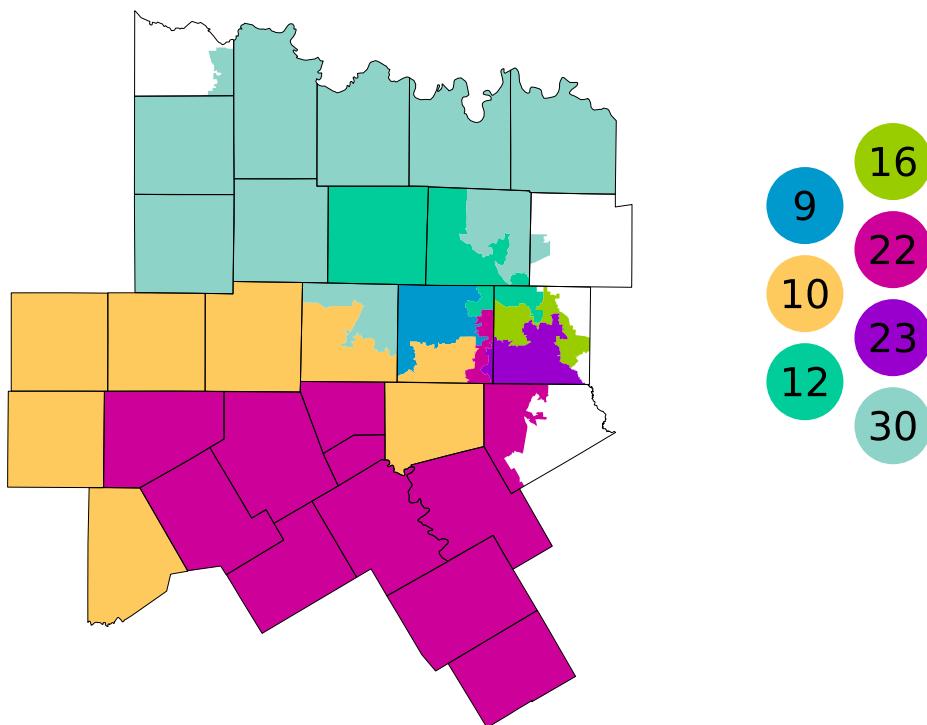
Figure 6: Though Tarrant and Dallas Counties have almost exactly 5 Senate districts' worth of population, their territory is shared among 8 districts in the enacted plan, touching dozens of counties.

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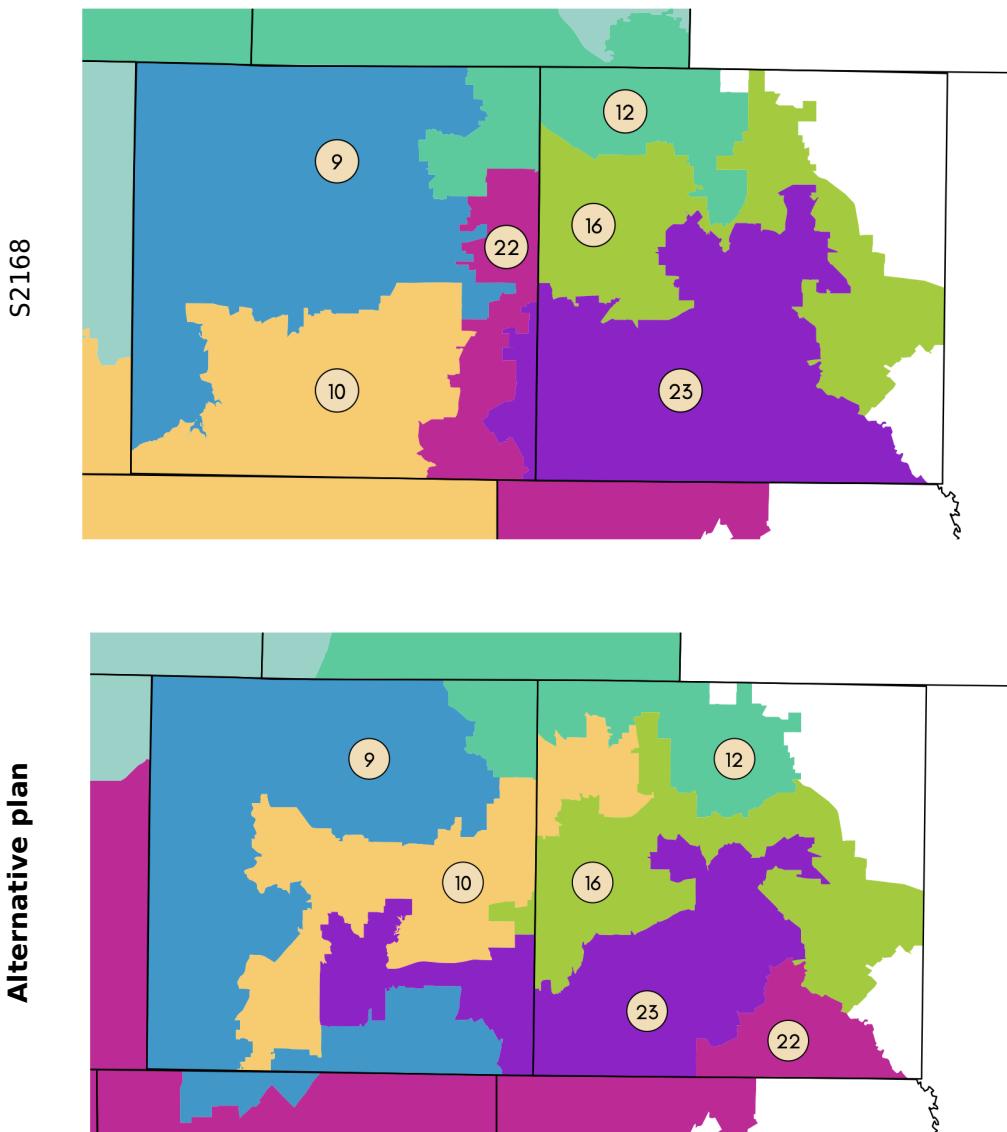
Figure 7: A close-up view of how Senate districts meet Tarrant and Dallas Counties in the state's plan (top) and an alternative plan covering the exact same terrain (bottom).

5.4   Senate districts around Fort Bend (S2)

Next, we move to the 5-district Senate cluster S2 in and near Fort Bend County. The alternative plan adds a majority-coalition district (SD 17) while retaining majority HCVAP in SD 6 and majority BCVAP in SD 15. This is accomplished with a plan that is far more compact than the enacted plan.

SD	S2168					Alternative plan				
	Black CVAP	Hisp CVAP	AAPI CVAP	BHA CVAP	Polsby Popper	Black CVAP	Hisp CVAP	AAPI CVAP	BHA CVAP	Polsby Popper
6	18.66%	60.40%	2.89%	81.96%	0.07	20.06%	57.17%	2.68%	79.91%	0.089
13	50.01%	23.09%	9.11%	82.22%	0.12	51.50%	25.06%	4.72%	81.28%	0.142
15	24.01%	27.61%	7.66%	59.28%	0.072	16.17%	27.33%	9.84%	53.34%	0.217
17	12.47%	21.34%	9.15%	42.96%	0.125	17.24%	24.47%	15.58%	57.29%	0.319
18	14.88%	24.92%	9.74%	49.55%	0.107	13.42%	23.31%	5.82%	42.55%	0.205
Avg					0.099					0.194

Table 13: Demographic and compactness comparison between plans.
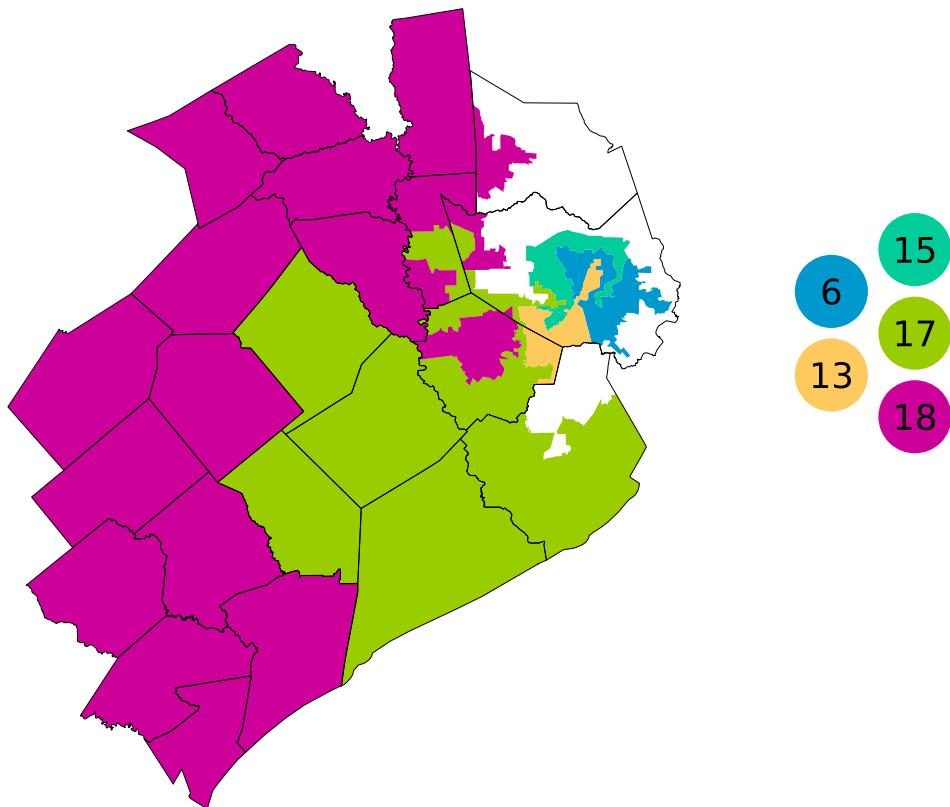
Figure 8: A wide view of enacted Senate districts in the Fort Bend area.

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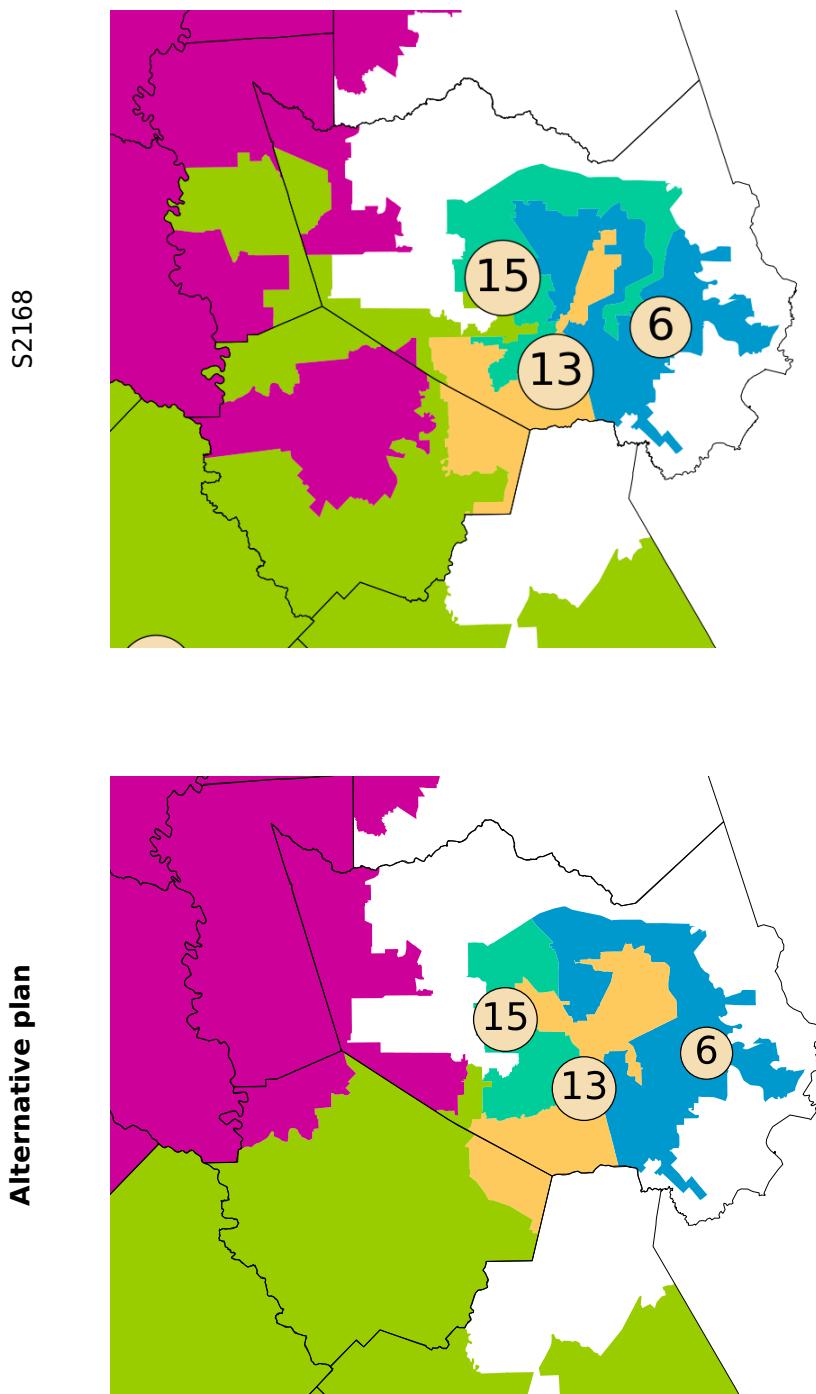
Figure 9: A close-up view of Senate districts near Fort Bend in the state's plan (top) and an alternative plan covering the exact same terrain (bottom).

5.5   House districts in Tarrant (H1)

Turning to the state House, we begin with the 11-district cluster H1 in and around Tarrant County. The alternative plan adds a majority-coalition district (HD 94) with slightly improved compactness overall. The alternative plan retains HD 90 as a majority-HCVAP district.

HD	H2316					Alternative plan				
	Black CVAP	Hisp CVAP	AAPI CVAP	BHA CVAP	Polsby Popper	Black CVAP	Hisp CVAP	AAPI CVAP	BHA CVAP	Polsby Popper
90	18.0%	51.04%	2.09%	71.13%	0.07	9.71%	53.84%	2.34%	65.89%	0.149
91	6.20%	18.30%	5.93%	30.43%	0.443	12.16%	15.26%	7.02%	34.44%	0.222
92	26.95%	23.14%	7.38%	57.47%	0.098	21.52%	25.76%	7.0%	54.29%	0.373
93	10.33%	16.56%	6.59%	33.47%	0.306	8.67%	16.15%	8.22%	33.04%	0.253
94	12.55%	13.63%	5.46%	31.63%	0.078	34.36%	19.01%	4.71%	58.07%	0.239
95	48.11%	21.04%	2.75%	71.90%	0.089	47.31%	24.50%	2.70%	74.51%	0.222
96	18.47%	13.22%	4.45%	36.14%	0.181	13.97%	13.94%	4.04%	31.95%	0.157
97	10.22%	15.66%	3.40%	29.28%	0.264	11.97%	17.18%	2.69%	31.84%	0.229
98	5.71%	9.90%	6.68%	22.29%	0.454	4.01%	10.99%	6.05%	21.04%	0.280
99	9.49%	22.38%	1.94%	33.81%	0.248	6.77%	17.52%	2.33%	26.62%	0.282
101	32.49%	22.43%	11.13%	66.05%	0.324	28.62%	17.64%	9.12%	55.38%	0.202
Avg					0.232					0.237

Table 14: Demographic and compactness comparison between plans.
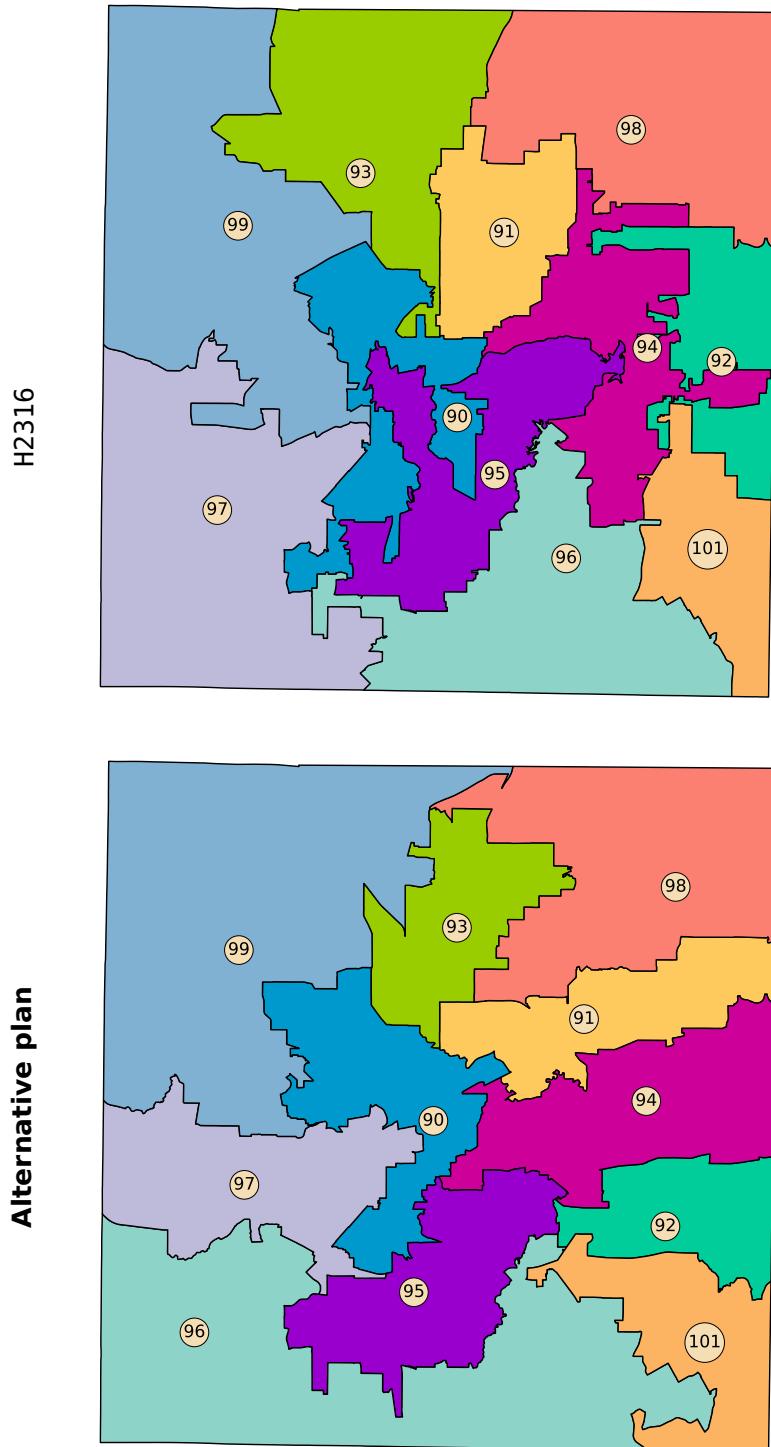
Figure 10: The House districts covering Tarrant County in the state's plan (top) and an alternative plan (bottom).

5.6 House districts in Denton/Wise (H3)

Next, we move to the 5-district House cluster H3 in Denton and Wise Counties. In the alternative plan, HD 65 is returned to a nearly identical configuration to the benchmark plan, giving a majority-coalition district in a far more compact plan than H2316.

HD	H2316					Alternative plan				
	Black CVAP	Hisp CVAP	AAPI CVAP	BHA CVAP	Polsby Popper	Black CVAP	Hisp CVAP	AAPI CVAP	BHA CVAP	Polsby Popper
57	11.85%	13.22%	4.13%	29.20%	0.188	9.04%	12.93%	3.22%	25.19%	0.455
63	10.18%	15.54%	9.01%	34.74%	0.258	4.42%	9.81%	5.70%	19.93%	0.324
64	8.17%	14.37%	2.46%	25.0%	0.444	7.59%	14.04%	2.42%	24.05%	0.535
65	12.03%	13.81%	9.04%	34.88%	0.159	18.44%	20.10%	11.67%	50.21%	0.28
106	9.85%	11.87%	8.33%	30.05%	0.323	12.88%	12.51%	9.96%	35.35%	0.337
Avg					0.275					0.386

Table 15: Demographic and compactness comparison between plans.
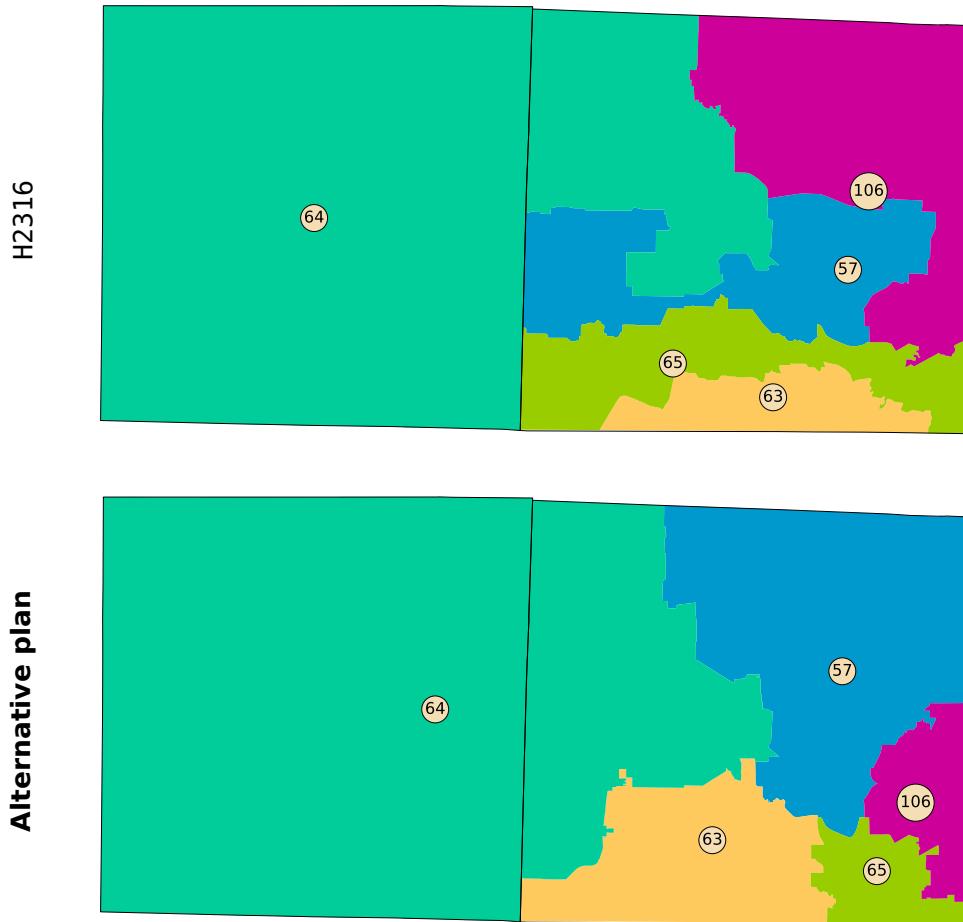

Figure 11: The House districts covering Wise and Denton Counties in the state's plan (top) and an alternative plan (bottom).

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5.7   House districts in Lubbock County (H4)

In Lubbock County (H4), the alternative plan keeps one district entirely within the county, creates a majority-coalition district, and greatly improves compactness. The new majority-coalition district is heavily Latino.

HD	H2316					Alternative plan				
	Black CVAP	Hisp CVAP	AAPI CVAP	BHA CVAP	Polsby Popper	Black CVAP	Hisp CVAP	AAPI CVAP	BHA CVAP	Polsby Popper
83	4.17%	29.40%	0.98%	34.56%	0.337	8.95%	42.22%	0.90%	52.07%	0.354
84	9.15%	35.24%	1.91%	46.30%	0.256	4.70%	23.39%	1.98%	30.08%	0.431
Avg					0.296					0.393

Table 16: Demographic and compactness comparison between plans.
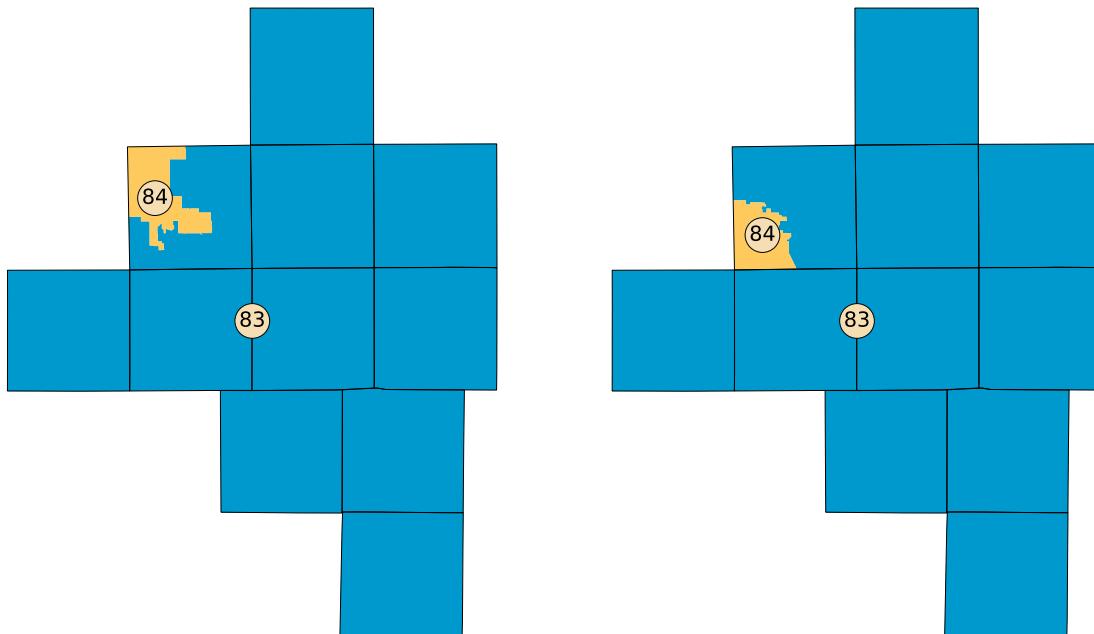

Figure 12: The state's House plan for districts touching Lubbock County, and an alternative plan.

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5.8   House districts in Brazoria County (H5)

In Brazoria County (H5), the alternative plan creates a majority-coalition district with a considerably more compact configuration.

HD	H2316					Alternative plan				
	Black CVAP	Hisp CVAP	AAPI CVAP	BHA CVAP	Polsby Popper	Black CVAP	Hisp CVAP	AAPI CVAP	BHA CVAP	Polsby Popper
25	16.77%	24.75%	5.46%	46.98%	0.197	9.20%	27.18%	1.16%	37.54%	0.381
29	14.57%	25.59%	5.69%	45.85%	0.304	23.03%	22.89%	10.58%	56.50%	0.170
Avg					0.251					0.276

Table 17: Demographic and compactness comparison between plans.
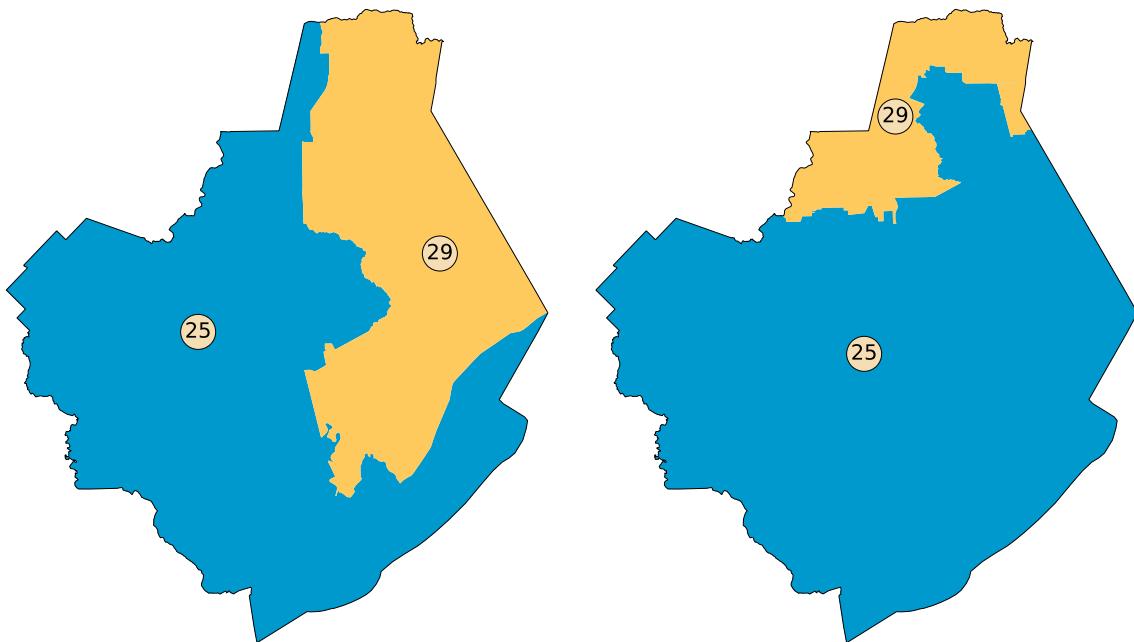
Figure 13: The state's House plan for the districts that make up Brazoria County, and an alternative plan.

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6   Polarized voting

In this section I will summarize the findings from a thorough inquiry into racially polarized voting in Texas generally, and in the counties covering the VRA Section 2 claims by the Texas NAACP specifically.

6.1   Methods

To measure voting polarization, I employ an implementation of King's ecological inference (or "EI") package that has been developed by members of my Lab and our collaborators in the Python programming language.[4]   My research group has multiple peer-reviewed publications on the methodology for ecological inference and best practices for using it in complex, multi-racial electoral settings [4, 1, 3].

EI is the industry-leading method for approaching the so-called "ecological inference problem": since U.S. elections are conducted by secret ballot, there is no way to be certain about patterns of voter preference by race and ethnicity. We must typically infer voter preference from ancillary data, such as by comparing the cast votes by precinct to the census demographics of the precinct. As a general matter: if precincts whose population is more heavily composed of White population systematically prefer one set of candidates, while more heavily non-White precincts systematically prefer other candidates, then we can conclude with high confidence that the groups' **candidate of choice** differ.

So-called "$R \times C$" EI lets you choose R racial groups and C candidates; one powerful technique for estimating turnout by race is to build in a dummy candidate representing "No Vote." The rate at which each group does not vote can then be converted to a **turnout estimate**.

Below, I will produce both statewide and regional estimates of voting preference by racial group. In this report, I will attempt to carefully explain the settings where EI provides higher or lower confidence and will justify why I have relied on EI in some ways and not others.

6.1.1   Diagnostics

I have performed many robustness checks, such as (a) running four-way (i.e., with Black/Hispanic/Asian/Other as four separate groups) or two-way (combining the minority groups so that the groupings are Coalition/Other); (b) running with VAP or CVAP as a population basis; (c) comparing full statewide runs to cluster-level data extracted from statewide runs or to cluster-specific runs; and (d) carefully monitoring the convergence diagnostics. These methodological checks have left me with high confidence in the conclusions presented here.

6.1.2   Elections, turnout and the use of primaries

I have considered all 19 statewide general elections that took place from 2012-2020, as provided in the Texas Legislative Council data. For a comprehensive analysis such as the one conducted here, statewide elections are preferred to districted elections because they allow for regional comparisons, and their results can be assessed for proposed districts as well as for benchmark districts.

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[4]To be precise, the Python package PyEI implements $R \times C$ multinomial Dirichlet, a Bayesian hierarchical model that is identical to the one in the R package eiPack.

EI is at its strongest when the number of racial groups and candidates is modest, the number of precincts is large, and there is considerable variation in demographics (i.e., some precincts have a high share of each group and some precincts have a low share). It is at its weakest when trying to make inferences about a small group that is not geographically concentrated (so that all precincts have about the same makeup), or when trying to recover missing data for many variables.

The turnout dynamics in Texas have a major impact on the power and accuracy of EI— and all inference methods that compare precinct demographics to past votes. Consider the number of votes cast across different election types.[5] Since 2016, general elections in Texas have always had at least 8 million cast votes—2016 and 2020 were presidential years, which typically have higher turnout, and 2018 was considered a wave year, where in Texas in particular the interest in the Senate contest between O'Rourke and Cruz was very high. The midterms in 2014 had the fewest cast votes of any in the last cycle, ranging from about 4.63 million in the Governor's race to about 4.37 million down-ballot.

By contrast, turnout in Democratic primary and runoff elections never reached 2 million, and even fell below 200,000 on a few occasions. Typical turnout in these primary and runoff elections is only 5% of citizens of voting age, starkly different from the over 50% of adult citizens who cast votes for even, say, the Railroad Commissioner in a general election. This means that the dummy candidate "No Vote" becomes dominant in primary elections and can wash out the signal of preference between the actual candidates on the ballot. I have conducted a preliminary review using the same methodology for primaries; I found that the outputs tended to come with indicators of lower confidence, but concluded that this should not be interpreted to mean that the group lacks cohesion. Instead, this only reflects that the problem specification produced adverse conditions for the statistical method on the regional level.

All of this means that EI will produce highly reliable estimates by subgroup in Texas general elections, which have relatively high turnout (overall and from each racial group) and only two major candidates. Primary elections give a far weaker signal of voting patterns by race because of low turnout and many candidates; runoff elections have only two candidates but have the lowest turnout of all.

In the following sections, I will review the patterns in 19 general elections both on a statewide basis and in the individual county clusters. Across the board, they show that Black, Hispanic, and Asian voters share a clear preference for the same general election candidates, while the balance of Texans—numerically dominated by White voters—have an equally clear preference for other candidates.

6.2 Key to RPV tables

The tables in this section have the following data.

- BHA est – point estimate of support for the given candidate from the combined coalition of Black, Hispanic, and Asian voters

- O (2way) – point estimate of support from Other, i.e., non-coalition (mostly White) voters when the EI is run with $R = 2$ racial groups

- B est, H est, A est – point estimate of support from individual minority groups of Black voters, Hispanic voters, and Asian voters, respectively

- O (4way) – point estimate of support for the given candidate from Other, i.e., non-coalition (mostly White) voters when the EI is run with $R = 4$ racial groups

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[5]To be precise, I am considering votes cast for candidates who received at least 5% of the vote, whom I label "non-marginal" candidates.

- conf – a *confidence score* indicating how likely this candidate is to be the group's candidate of choice. This score is derived by drawing between 2000 and 8000 times from the beta distributions learned by the EI model. A score of 1 indicates that the candidate had the most votes in every single draw. A score of 0.752, for instance, means they led on over 75% of draws. In the tables, I have shaded light gray all estimates with a confidence score below 90%, and in dark gray all estimates with a confidence score below 60%. These are regarded as uncertain.

6.3 Statewide

Contest	Candidates	BHA est	conf	O (2way)	conf	B est	conf	H est	conf	A est	conf	O (4way)	conf
President 2012	Barack Obama	0.893	1	0.166	0	0.932	1	0.855	1	0.668	1	0.172	0
	Mitt Romney	0.107	0	0.835	1	0.068	0	0.145	0	0.332	0	0.828	1
U.S. Senate 2012	Ted Cruz	0.130	0	0.816	1	0.069	0	0.186	0	0.370	0	0.808	1
	Paul Sadler	0.870	1	0.184	0	0.931	1	0.814	1	0.630	1	0.192	0
Ag. Comm. 2014	Jim Hogan	0.903	1	0.186	0	0.936	1	0.867	1	0.615	0.960	0.197	0
	Sid Miller	0.097	0	0.814	1	0.064	0	0.133	0	0.385	0.040	0.803	1
Governor 2014	Greg Abbott	0.110	0	0.798	1	0.063	0	0.169	0	0.348	0	0.785	1
	Wendy Davis	0.890	1	0.202	0	0.937	1	0.832	1	0.652	1	0.215	0
Lt. Governor 2014	Dan Patrick	0.096	0	0.802	1	0.065	0	0.134	0	0.324	0	0.789	1
	Leticia VanDePutte	0.904	1	0.198	0	0.935	1	0.866	1	0.676	1	0.211	0
RR Comm. 2014	Steve Brown	0.908	1	0.185	0	0.937	1	0.869	1	0.629	1	0.196	0
	Ryan Sitton	0.092	0	0.815	1	0.063	0	0.131	0	0.371	0	0.804	1
U.S. Senate 2014	David Alameel	0.886	1	0.157	0	0.936	1	0.823	1	0.660	1	0.168	0
	John Cornyn	0.114	0	0.843	1	0.640	0	0.178	0	0.341	0	0.832	1
President 2016	Hillary Clinton	0.909	1	0.196	0	0.944	1	0.867	1	0.852	1	0.193	0
	Donald Trump	0.091	0	0.804	1	0.056	0	0.133	0	0.148	0	0.807	1
RR Comm. 2016	Wayne Christian	0.087	0	0.839	1	0.056	0	0.121	0	0.190	0	0.838	1
	Grady Yarbrough	0.913	1	0.161	0	0.944	1	0.879	1	0.810	1	0.162	0
Atty. General 2018	Justin Nelson	0.914	1	0.255	0	0.943	1	0.867	1	0.876	1	0.246	0
	Ken Paxton	0.086	0	0.745	1	0.057	0	0.133	0	0.124	0	0.754	1
Comptroller 2018	Joi Chevalier	0.913	1	0.207	0	0.947	1	0.870	1	0.867	1	0.197	0
	Glenn Hegar	0.087	0	0.793	1	0.053	0	0.130	0	0.133	0	0.803	1
Governor 2018	Greg Abbott	0.123	0	0.802	1	0.061	0	0.186	0	0.133	0	0.814	1
	Lupe Valdez	0.877	1	0.198	0	0.939	1	0.814	1	0.868	1	0.186	0
Land Comm. 2018	George P. Bush	0.101	0	0.795	1	0.055	0	0.158	0	0.134	0	0.805	1
	Miguel Suazo	0.899	1	0.205	0	0.945	1	0.842	1	0.866	1	0.195	0
Lt. Governor 2018	Mike Collier	0.902	1	0.254	0	0.943	1	0.853	1	0.871	1	0.245	0
	Dan Patrick	0.098	0	0.746	1	0.057	0	0.147	0	0.129	0	0.755	1
RR Comm. 2018	Christi Craddick	0.083	0	0.794	1	0.054	0	0.129	0	0.136	0	0.802	1
	Roman McAllen	0.917	1	0.206	0	0.946	1	0.871	1	0.864	1	0.198	0
U.S. Senate 2018	Ted Cruz	0.086	0	0.743	1	0.057	0	0.133	0	0.119	0	0.751	1
	Beto O'Rourke	0.914	1	0.257	0	0.943	1	0.867	1	0.881	1	0.249	0
President 2020	Joe Biden	0.856	1	0.252	0	0.945	1	0.772	1	0.888	1	0.241	0
	Donald Trump	0.144	0	0.748	1	0.055	0	0.228	0	0.112	0	0.759	1
RR Comm. 2020	Chrysta Castaneda	0.874	1	0.217	0	0.946	1	0.806	1	0.874	1	0.205	0
	James Wright	0.126	0	0.783	1	0.054	0	0.194	0	0.126	0	0.795	1
U.S. Senate 2020	John Cornyn	0.141	0	0.774	1	0.055	0	0.223	0	0.128	0	0.785	1
	MJ Hegar	0.859	1	0.226	0	0.945	1	0.778	1	0.872	1	0.216	0

Table 18: Statewide results.

The coalition of Black, Latino, and Asian voters has supported its preferred candidate at an estimated rate of at least 85% in all 19 contests. Other/White voters have gone the other way, backing the Republican at an estimated rate of at least 74% in all 19 contests. In every case, this has been enough to block the minority-preferred candidate from office. Indeed, no Democrat has won statewide office in Texas since 1994, the longest such streak in the nation.

To illustrate these findings, let us focus on one election—the contest between Lupe Valdez and Greg Abbott for Governor in 2018—and consider plots that show the estimated support level of each group and help to visualize the confidence in this determination.

Taller and skinnier distributions are more certain; fatter distributions have probability that is more spread out over different values. This plot illustrates that whether grouped together as a coalition or considered individually, Black, Hispanic, and Asian voters all prefer Lupe Valdez by at least 4 to 1, while Other (mostly White) voters lean equally far toward her opponent, Greg Abbott.
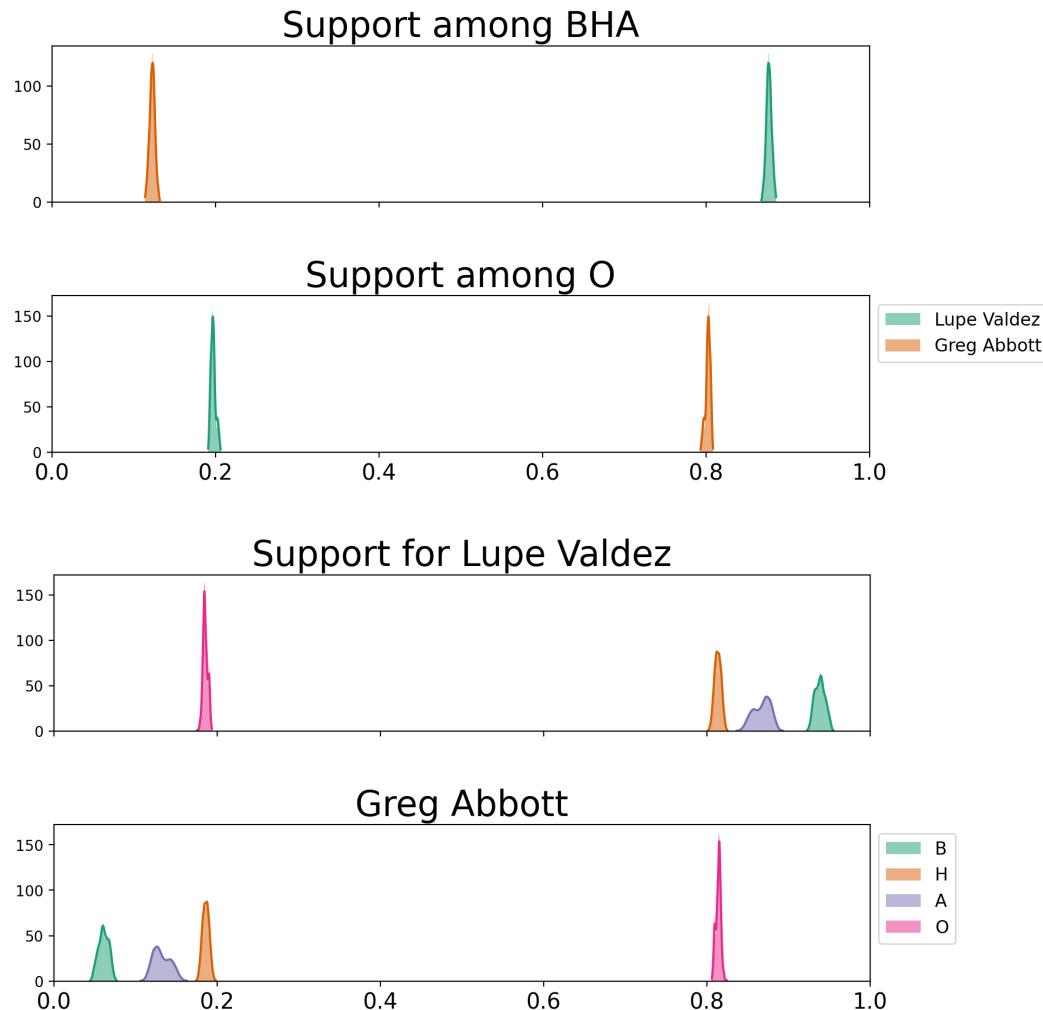

Figure 14: Estimated voting behavior of the Black+Hispanic+Asian (BHA) coalition versus (mostly White) Other (O) voters in the 2018 race for Governor. Top: Combined support of the coalition is starkly different from the rest of the population. Bottom: We can break this down by individual groups to get a clear picture of group preference.

6.4 Tarrant/Dallas

6.4.1 Candidates of choice

Contest	Candidates	BHA est	conf	O (2way)	conf	B est	conf	H est	conf	A est	conf	O (4way)	conf
President 2012	Barack Obama	0.945	1	0.244	0	0.961	1	0.911	1	0.535	0.752	0.261	0
	Mitt Romney	0.055	0	0.756	1	0.039	0	0.089	0	0.465	0.248	0.739	1
U.S. Senate 2012	Ted Cruz	0.061	0	0.753	1	0.042	0	0.112	0	0.410	0.006	0.740	1
	Paul Sadler	0.939	1	0.247	0	0.958	1	0.888	1	0.590	0.994	0.260	0
Ag. Comm. 2014	Jim Hogan	0.942	1	0.264	0	0.960	1	0.902	1	0.516	0.649	0.272	0
	Sid Miller	0.058	0	0.736	1	0.041	0	0.098	0	0.484	0.351	0.728	1
Governor 2014	Greg Abbott	0.060	0	0.692	1	0.042	0	0.108	0	0.485	0.546	0.688	1
	Wendy Davis	0.940	1	0.308	0	0.958	1	0.892	1	0.515	0.454	0.312	0
Lt. Governor 2014	Dan Patrick	0.063	0	0.694	1	0.045	0	0.112	0	0.485	0.494	0.689	1
	Leticia VanDePutte	0.937	1	0.306	0	0.955	1	0.888	1	0.515	0.506	0.311	0
RR Comm. 2014	Steve Brown	0.937	1	0.267	0	0.961	1	0.901	1	0.536	0.784	0.272	0
	Ryan Sitton	0.063	0	0.733	1	0.039	0	0.099	0	0.464	0.216	0.728	1
U.S. Senate 2014	David Alameel	0.943	1	0.245	0	0.957	1	0.889	1	0.593	0.753	0.251	0
	John Cornyn	0.057	0	0.755	1	0.043	0	0.111	0	0.407	0.247	0.749	1
President 2016	Hillary Clinton	0.957	1	0.326	0	0.966	1	0.941	1	0.648	0.986	0.342	0
	Donald Trump	0.043	0	0.674	1	0.034	0	0.059	0	0.352	0.014	0.658	1
RR Comm. 2016	Wayne Christian	0.041	0	0.746	1	0.033	0	0.056	0	0.365	0	0.727	1
	Grady Yarbrough	0.959	1	0.254	0	0.967	1	0.944	1	0.635	1	0.273	0
Atty. General 2018	Justin Nelson	0.958	1	0.394	0	0.966	1	0.942	1	0.689	1	0.407	0
	Ken Paxton	0.042	0	0.606	1	0.034	0	0.058	0	0.311	0	0.593	1
Comptroller 2018	Joi Chevalier	0.960	1	0.340	0	0.967	1	0.949	1	0.718	1	0.351	0
	Glenn Hegar	0.040	0	0.660	1	0.033	0	0.051	0	0.282	0	0.649	1
Governor 2018	Greg Abbott	0.050	0	0.684	1	0.049	0	0.057	0	0.294	0	0.671	1
	Lupe Valdez	0.951	1	0.316	0	0.951	1	0.943	1	0.706	1	0.329	0
Land Comm. 2018	George P. Bush	0.041	0	0.681	1	0.038	0	0.060	0	0.324	0	0.666	1
	Miguel Suazo	0.959	1	0.319	0	0.962	1	0.940	1	0.676	1	0.334	0
Lt. Governor 2018	Mike Collier	0.959	1	0.378	0	0.964	1	0.940	1	0.697	1	0.392	0
	Dan Patrick	0.041	0	0.623	1	0.036	0	0.060	0	0.303	0	0.608	1
RR Comm. 2018	Christi Craddick	0.041	0	0.663	1	0.035	0	0.053	0	0.281	0	0.651	1
	Roman McAllen	0.960	1	0.337	0	0.966	1	0.947	1	0.719	1	0.349	0
U.S. Senate 2018	Ted Cruz	0.043	0	0.590	1	0.035	0	0.056	0	0.325	0	0.579	1
	Beto O'Rourke	0.957	1	0.410	0	0.965	1	0.944	1	0.675	1	0.421	0
President 2020	Joe Biden	0.943	1	0.401	0	0.964	1	0.899	1	0.728	1	0.407	0
	Donald Trump	0.058	0	0.599	1	0.036	0	0.101	0	0.272	0	0.593	1
RR Comm. 2020	Chrysta Castaneda	0.949	1	0.352	0	0.966	1	0.918	1	0.701	1	0.358	0
	James Wright	0.051	0	0.648	1	0.034	0	0.082	0	0.299	0	0.642	1
U.S. Senate 2020	John Cornyn	0.058	0	0.640	1	0.037	0	0.093	0	0.302	0	0.637	1
	MJ Hegar	0.942	1	0.359	0	0.963	1	0.906	1	0.698	1	0.363	0

Table 19: Tarrant/Dallas results.

Asian voters were assessed to have less than a 90% confidence score for their candidate of choice six times, all in 2012 or 2014 (shaded in the table above). The confidence dipped below 60% in two of those contests (shaded dark gray). For the other 108 outcomes reported here, the confidence score is at least 98%.

Black voters' support for the POC candidate of choice is uniformly above 95% cohesion. **Latino** support is always above 88%. **Asian** support, in elections with confidence scores over 90%, has always stayed above 59%—and in the twelve contests since 2016, each one has Asian support for the POC-preferred candidate estimated at 63% or higher. Meanwhile, **Other/White** voters have always inclined the opposite way, supporting the Republican at shares of at least 58%.

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6.5 Harris/Fort Bend

6.5.1 Candidates of choice

Contest	Candidates	BHA est	conf	O (2way)	conf	B est	conf	H est	conf	A est	conf	O (4way)	conf
President 2012	Barack Obama	0.925	1	0.152	0	0.963	1	0.873	1	0.598	0.999	0.177	0
	Mitt Romney	0.075	0	0.848	1	0.037	0	0.127	0	0.402	0.001	0.823	1
U.S. Senate 2012	Ted Cruz	0.084	0	0.846	1	0.039	0	0.153	0	0.431	0.14	0.824	1
	Paul Sadler	0.916	1	0.154	0	0.961	1	0.847	1	0.569	0.86	0.176	0
Ag. Comm. 2014	Jim Hogan	0.939	1	0.170	0	0.963	1	0.873	1	0.600	0.979	0.190	0
	Sid Miller	0.061	0	0.830	1	0.037	0	0.127	0	0.400	0.021	0.810	1
Governor 2014	Greg Abbott	0.075	0	0.769	1	0.036	0	0.150	0	0.453	0.148	0.760	1
	Wendy Davis	0.925	1	0.231	0	0.964	1	0.850	1	0.547	0.852	0.240	0
Lt. Governor 2014	Dan Patrick	0.075	0	0.764	1	0.038	0	0.170	0	0.446	0.139	0.752	1
	Leticia VanDePutte	0.925	1	0.235	0	0.962	1	0.831	1	0.554	0.861	0.248	0
RR Comm. 2014	Steve Brown	0.937	1	0.176	0	0.961	1	0.883	1	0.584	0.952	0.193	0
	Ryan Sitton	0.063	0	0.824	1	0.039	0	0.117	0	0.416	0.048	0.807	1
U.S. Senate 2014	David Alameel	0.926	1	0.168	0	0.962	1	0.842	1	0.487	0.410	0.184	0
	John Cornyn	0.074	0	0.833	1	0.038	0	0.158	0	0.513	0.590	0.816	1
President 2016	Hillary Clinton	0.950	1	0.256	0	0.971	1	0.918	1	0.777	1	0.264	0
	Donald Trump	0.050	0	0.744	1	0.029	0	0.082	0	0.223	0	0.736	1
RR Comm. 2016	Wayne Christian	0.054	0	0.833	1	0.027	0	0.074	0	0.267	0	0.821	1
	Grady Yarbrough	0.946	1	0.167	0	0.973	1	0.926	1	0.733	1	0.179	0
Atty. General 2018	Justin Nelson	0.941	1	0.324	0	0.969	1	0.901	1	0.786	1	0.325	0
	Ken Paxton	0.059	0	0.676	1	0.032	0	0.099	0	0.214	0	0.675	1
Comptroller 2018	Joi Chevalier	0.943	1	0.254	0	0.971	1	0.920	1	0.764	1	0.252	0
	Glenn Hegar	0.057	0	0.746	1	0.029	0	0.080	0	0.236	0	0.748	1
Governor 2018	Greg Abbott	0.084	0	0.751	1	0.052	0	0.123	0	0.261	0	0.747	1
	Lupe Valdez	0.916	1	0.249	0	0.948	1	0.877	1	0.739	1	0.253	0
Land Comm. 2018	George P. Bush	0.064	0	0.734	1	0.033	0	0.098	0	0.248	0	0.729	1
	Miguel Suazo	0.936	1	0.266	0	0.967	1	0.902	1	0.752	1	0.271	0
Lt. Governor 2018	Mike Collier	0.935	1	0.314	0	0.966	1	0.887	1	0.788	1	0.311	0
	Dan Patrick	0.065	0	0.686	1	0.034	0	0.113	0	0.212	0	0.689	1
RR Comm. 2018	Christi Craddick	0.057	0	0.747	1	0.028	0	0.084	0	0.230	0	0.748	1
	Roman McAllen	0.943	1	0.253	0	0.973	1	0.916	1	0.770	1	0.252	0
U.S. Senate 2018	Ted Cruz	0.058	0	0.667	1	0.030	0	0.095	0	0.191	0	0.673	1
	Beto O'Rourke	0.942	1	0.333	0	0.970	1	0.905	1	0.809	1	0.327	0
President 2020	Joe Biden	0.873	1	0.322	0	0.968	1	0.754	1	0.715	1	0.327	0
	Donald Trump	0.127	0	0.678	1	0.032	0	0.246	0	0.285	0	0.673	1
RR Comm. 2020	Chrysta Castaneda	0.896	1	0.272	0	0.969	1	0.813	1	0.681	1	0.287	0
	James Wright	0.104	0	0.728	1	0.031	0	0.187	0	0.319	0	0.713	1
U.S. Senate 2020	John Cornyn	0.122	0	0.715	1	0.029	0	0.235	0	0.325	0	0.704	1
	MJ Hegar	0.878	1	0.285	0	0.971	1	0.765	1	0.675	1	0.296	0

Table 20: Harris/Fort Bend results.

In Harris/Fort Bend, as in Tarrant/Dallas, the only relatively higher uncertainty attaches to Asian voting preferences in 2012 and 2014 (shaded in the table above). Since mid-decade, all groups give extremely clear candidates of choice.

Among contests with at least 90% confidence score:

- **Black** support for D is at least 95%;

- **Latino** support for D is at least 88%;

- **Asian** support for D is at least 58% (and at least 67% since 2016);

- **Other/White** support for R is at least 67%.

6.6 Denton/Wise

6.6.1 Candidates of choice

Contest	Candidates	BHA est	conf	O (2way)	conf	B est	conf	H est	conf	A est	conf	O (4way)	conf
President 2012	Barack Obama	0.910	1	0.189	0	0.723	0.917	0.851	1	0.788	0.998	0.209	0
	Mitt Romney	0.090	0	0.811	1	0.277	0.083	0.149	0	0.211	0.002	0.791	1
U.S. Senate 2012	Ted Cruz	0.098	0	0.807	1	0.256	0.085	0.144	0.004	0.255	0.022	0.786	1
	Paul Sadler	0.902	1	0.193	0	0.744	0.915	0.856	0.996	0.745	0.978	0.214	0
Ag. Comm. 2014	Jim Hogan	0.859	1	0.215	0	0.728	0.934	0.831	0.998	0.659	0.872	0.214	0
	Sid Miller	0.141	0	0.785	1	0.272	0.066	0.170	0.002	0.341	0.128	0.786	1
Governor 2014	Greg Abbott	0.143	0	0.749	1	0.282	0.074	0.158	0.001	0.347	0.134	0.749	1
	Wendy Davis	0.857	1	0.251	0	0.718	0.926	0.842	0.999	0.653	0.866	0.251	0
Lt. Governor 2014	Dan Patrick	0.149	0	0.757	1	0.259	0.057	0.209	0.004	0.304	0.087	0.754	1
	Leticia VanDePutte	0.851	1	0.243	0	0.741	0.943	0.791	0.996	0.696	0.913	0.246	0
RR Comm. 2014	Steve Brown	0.891	1	0.217	0	0.738	0.939	0.821	0.988	0.682	0.917	0.216	0
	Ryan Sitton	0.109	0	0.783	1	0.262	0.061	0.179	0.012	0.318	0.083	0.784	1
U.S. Senate 2014	David Alameel	0.887	1	0.192	0	0.738	0.935	0.825	1	0.651	0.865	0.194	0
	John Cornyn	0.113	0	0.808	1	0.262	0.065	0.175	0	0.349	0.135	0.806	1
President 2016	Hillary Clinton	0.919	1	0.209	0	0.829	0.987	0.868	1	0.867	1	0.236	0
	Donald Trump	0.081	0	0.791	1	0.172	0.013	0.132	0	0.133	0	0.764	1
RR Comm. 2016	Wayne Christian	0.074	0	0.844	1	0.155	0.004	0.155	0	0.161	0	0.816	1
	Grady Yarbrough	0.926	1	0.156	0	0.845	0.996	0.845	1	0.839	1	0.184	0
Atty. General 2018	Justin Nelson	0.944	1	0.269	0	0.906	1	0.779	0.988	0.859	1	0.309	0
	Ken Paxton	0.057	0	0.731	1	0.094	0	0.221	0.012	0.141	0	0.691	1
Comptroller 2018	Joi Chevalier	0.937	1	0.220	0	0.915	1	0.786	0.996	0.856	1	0.256	0
	Glenn Hegar	0.063	0	0.780	1	0.085	0	0.214	0.004	0.144	0	0.744	1
Governor 2018	Greg Abbott	0.062	0	0.798	1	0.095	0	0.168	0.001	0.176	0	0.758	1
	Lupe Valdez	0.938	1	0.202	0	0.905	1	0.833	0.999	0.824	1	0.242	0
Land Comm. 2018	George P. Bush	0.058	0	0.798	1	0.079	0	0.191	0.005	0.172	0	0.757	1
	Miguel Suazo	0.942	1	0.202	0	0.921	1	0.809	0.995	0.828	1	0.243	0
Lt. Governor 2018	Mike Collier	0.939	1	0.269	0	0.912	1	0.800	0.991	0.851	1	0.300	0
	Dan Patrick	0.061	0	0.732	1	0.088	0	0.200	0.009	0.149	0	0.700	1
RR Comm. 2018	Christi Craddick	0.063	0	0.786	1	0.088	0	0.183	0.008	0.159	0	0.746	1
	Roman McAllen	0.937	1	0.214	0	0.912	1	0.817	0.992	0.841	1	0.254	0
U.S. Senate 2018	Ted Cruz	0.051	0	0.724	1	0.086	0	0.210	0.005	0.121	0	0.681	1
	Beto O'Rourke	0.949	1	0.276	0	0.914	1	0.790	0.995	0.879	1	0.319	0
President 2020	Joe Biden	0.967	1	0.259	0	0.943	1	0.79	0.984	0.912	1	0.311	0
	Donald Trump	0.033	0	0.741	1	0.057	0	0.21	0.016	0.088	0	0.689	1
RR Comm. 2020	Chrysta Castaneda	0.969	1	0.215	0	0.944	1	0.831	0.998	0.876	1	0.268	0
	James Wright	0.031	0	0.785	1	0.057	0	0.169	0.002	0.124	0	0.732	1
U.S. Senate 2020	John Cornyn	0.026	0	0.778	1	0.059	0	0.185	0.007	0.128	0	0.722	1
	MJ Hegar	0.974	1	0.222	0	0.941	1	0.815	0.993	0.872	1	0.278	0

Table 21: Denton/Wise results.

Denton/Wise continues the pattern that relatively higher uncertainty (confidence score below 90%) attaches only to Asian voting preferences in 2012 and 2014 (shaded in the table above). Since mid-decade, all groups give extremely clear candidates of choice.

Among contests with at least 90% confidence score:

- **Black** support for D is at least 72%;

- **Latino** support for D is at least 77%;

- **Asian** support for D is at least 68% (and at least 82% since 2016);

- **Other/White** support for R is at least 68%.

6.7 Lubbock

6.7.1 Candidates of choice

Contest	Candidates	BHA est	conf	O (2way)	conf	B est	conf	H est	conf	A est	conf	O (4way)	conf
President 2012	Barack Obama	0.925	1	0.102	0	0.893	1	0.902	1	0.404	0.284	0.092	0
	Mitt Romney	0.075	0	0.898	1	0.107	0	0.098	0	0.596	0.716	0.908	1
U.S. Senate 2012	Ted Cruz	0.089	0	0.924	1	0.133	0	0.112	0	0.561	0.685	0.911	1
	Paul Sadler	0.911	1	0.076	0	0.867	1	0.888	1	0.439	0.315	0.089	0
Ag. Comm. 2014	Jim Hogan	0.922	1	0.110	0	0.900	1	0.860	1	0.616	0.743	0.112	0
	Sid Miller	0.078	0	0.890	1	0.100	0	0.140	0	0.384	0.257	0.888	1
Governor 2014	Greg Abbott	0.096	0	0.891	1	0.104	0	0.175	0	0.322	0.122	0.889	1
	Wendy Davis	0.904	1	0.109	0	0.896	1	0.825	1	0.678	0.878	0.111	0
Lt. Governor 2014	Dan Patrick	0.090	0	0.895	1	0.088	0	0.153	0.001	0.420	0.301	0.892	1
	Leticia VanDePutte	0.910	1	0.105	0	0.912	1	0.847	0.999	0.580	0.699	0.108	0
RR Comm. 2014	Steve Brown	0.921	1	0.099	0	0.905	1	0.847	1	0.601	0.758	0.102	0
	Ryan Sitton	0.079	0	0.901	1	0.095	0	0.153	0	0.399	0.242	0.898	1
U.S. Senate 2014	David Alameel	0.915	1	0.074	0	0.897	1	0.830	1	0.579	0.711	0.086	0
	John Cornyn	0.085	0	0.926	1	0.103	0	0.170	0	0.421	0.289	0.914	1
President 2016	Hillary Clinton	0.906	1	0.157	0	0.880	1	0.909	1	0.631	0.781	0.111	0
	Donald Trump	0.094	0	0.843	1	0.120	0	0.090	0	0.369	0.219	0.889	1
RR Comm. 2016	Wayne Christian	0.097	0	0.877	1	0.142	0	0.091	0	0.420	0.279	0.911	1
	Grady Yarbrough	0.903	1	0.123	0	0.858	1	0.909	1	0.580	0.721	0.089	0
Atty. General 2018	Justin Nelson	0.909	1	0.241	0	0.886	1	0.902	1	0.812	0.999	0.178	0
	Ken Paxton	0.091	0	0.759	1	0.114	0	0.098	0	0.188	0.001	0.822	1
Comptroller 2018	Joi Chevalier	0.911	1	0.181	0	0.905	1	0.891	1	0.778	0.996	0.119	0
	Glenn Hegar	0.089	0	0.819	1	0.095	0	0.109	0	0.222	0.004	0.881	1
Governor 2018	Greg Abbott	0.101	0	0.814	1	0.120	0	0.120	0	0.229	0.001	0.875	1
	Lupe Valdez	0.899	1	0.186	0	0.880	1	0.880	1	0.771	0.999	0.125	0
Land Comm. 2018	George P. Bush	0.094	0	0.822	1	0.100	0	0.115	0	0.207	0	0.878	1
	Miguel Suazo	0.906	1	0.178	0	0.900	1	0.885	1	0.793	1	0.122	0
Lt. Governor 2018	Mike Collier	0.908	1	0.264	0	0.890	1	0.875	1	0.761	0.990	0.209	0
	Dan Patrick	0.092	0	0.736	1	0.110	0	0.125	0	0.239	0.010	0.791	1
RR Comm. 2018	Christi Craddick	0.093	0	0.838	1	0.087	0	0.103	0	0.239	0.010	0.884	1
	Roman McAllen	0.907	1	0.162	0	0.913	1	0.897	1	0.761	0.990	0.116	0
U.S. Senate 2018	Ted Cruz	0.094	0	0.771	1	0.076	0	0.110	0	0.184	0.004	0.820	1
	Beto O'Rourke	0.906	1	0.229	0	0.924	1	0.890	1	0.816	0.996	0.180	0
President 2020	Joe Biden	0.866	1	0.251	0	0.884	1	0.874	1	0.765	0.967	0.197	0
	Donald Trump	0.134	0	0.750	1	0.116	0	0.126	0	0.235	0.033	0.803	1
RR Comm. 2020	Chrysta Castaneda	0.870	1	0.207	0	0.875	1	0.909	1	0.761	0.971	0.145	0
	James Wright	0.130	0	0.793	1	0.125	0	0.091	0	0.239	0.029	0.855	1
U.S. Senate 2020	John Cornyn	0.098	0	0.779	1	0.120	0	0.114	0	0.231	0.014	0.831	1
	MJ Hegar	0.902	1	0.221	0	0.880	1	0.886	1	0.769	0.986	0.169	0

Table 22: Lubbock results.

In Lubbock, relatively higher uncertainty (confidence score below 90%) is seen in Asian voting preferences up to 2016 (shaded in the table above). Since 2018, Asian voters give a very clear candidate of choice—and other groups have had clear choices throughout the decade.

Among contests with at least 90% confidence score:

- **Black** support for D is at least 85%;

- **Latino** support for D is at least 82%;

- **Asian** support for D is at least 76%;

- **Other/White** support for R is at least 73%.

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6.8 Brazoria

6.8.1 Candidates of choice

Contest	Candidates	BHA est	conf	O (2way)	conf	B est	conf	H est	conf	A est	conf	O (4way)	conf
President 2012	Barack Obama	0.883	1	0.089	0	0.874	1	0.754	0.984	0.750	0.990	0.122	0
	Mitt Romney	0.117	0	0.911	1	0.126	0	0.246	0.016	0.250	0.010	0.878	1
U.S. Senate 2012	Ted Cruz	0.143	0	0.899	1	0.133	0	0.263	0.022	0.259	0.006	0.864	1
	Paul Sadler	0.857	1	0.101	0	0.867	1	0.737	0.978	0.741	0.994	0.136	0
Ag. Comm. 2014	Jim Hogan	0.897	1	0.114	0	0.853	1	0.643	0.857	0.796	0.999	0.148	0
	Sid Miller	0.103	0	0.886	1	0.147	0	0.357	0.143	0.204	0.001	0.852	1
Governor 2014	Greg Abbott	0.097	0	0.886	1	0.153	0	0.358	0.158	0.175	0	0.840	1
	Wendy Davis	0.903	1	0.114	0	0.847	1	0.642	0.842	0.825	1	0.160	0
Lt. Governor 2014	Dan Patrick	0.130	0	0.866	1	0.159	0.002	0.404	0.256	0.182	0	0.836	1
	Leticia VanDePutte	0.871	1	0.134	0	0.841	0.998	0.596	0.744	0.818	1	0.164	0
RR Comm. 2014	Steve Brown	0.887	1	0.115	0	0.852	1	0.624	0.812	0.804	0.996	0.140	0
	Ryan Sitton	0.113	0	0.885	1	0.148	0	0.377	0.188	0.196	0.004	0.860	1
U.S. Senate 2014	David Alameel	0.888	1	0.085	0	0.857	0.997	0.627	0.828	0.793	0.995	0.117	0
	John Cornyn	0.112	0	0.915	1	0.143	0.003	0.373	0.172	0.207	0.005	0.883	1
President 2016	Hillary Clinton	0.924	1	0.070	0	0.915	1	0.760	0.994	0.887	1	0.124	0
	Donald Trump	0.076	0	0.930	1	0.085	0	0.240	0.006	0.113	0	0.876	1
RR Comm. 2016	Wayne Christian	0.121	0	0.930	1	0.115	0	0.240	0.008	0.205	0	0.891	1
	Grady Yarbrough	0.879	1	0.070	0	0.885	1	0.760	0.992	0.795	1	0.109	0
Atty. General 2018	Justin Nelson	0.922	1	0.090	0	0.907	1	0.771	0.996	0.887	1	0.146	0
	Ken Paxton	0.077	0	0.910	1	0.093	0	0.229	0.004	0.113	0	0.854	1
Comptroller 2018	Joi Chevalier	0.905	1	0.061	0	0.905	1	0.773	0.995	0.858	1	0.109	0
	Glenn Hegar	0.095	0	0.939	1	0.095	0	0.227	0.005	0.142	0	0.891	1
Governor 2018	Greg Abbott	0.120	0	0.935	1	0.137	0	0.249	0.009	0.170	0	0.896	1
	Lupe Valdez	0.880	1	0.065	0	0.864	1	0.751	0.991	0.830	1	0.104	0
Land Comm. 2018	George P. Bush	0.111	0	0.930	1	0.106	0	0.250	0.014	0.166	0	0.879	1
	Miguel Suazo	0.889	1	0.070	0	0.894	1	0.750	0.986	0.834	1	0.121	0
Lt. Governor 2018	Mike Collier	0.908	1	0.095	0	0.908	1	0.754	0.978	0.862	1	0.153	0
	Dan Patrick	0.092	0	0.905	1	0.091	0	0.246	0.022	0.138	0	0.847	1
RR Comm. 2018	Christi Craddick	0.088	0	0.933	1	0.090	0	0.231	0.002	0.145	0	0.883	1
	Roman McAllen	0.912	1	0.067	0	0.910	1	0.769	0.998	0.855	1	0.117	0
U.S. Senate 2018	Ted Cruz	0.061	0	0.914	1	0.086	0	0.212	0.006	0.095	0	0.862	1
	Beto O'Rourke	0.939	1	0.086	0	0.914	1	0.788	0.994	0.905	1	0.138	0
President 2020	Joe Biden	0.934	1	0.063	0	0.937	1	0.761	0.991	0.886	1	0.124	0
	Donald Trump	0.066	0	0.937	1	0.063	0	0.239	0.009	0.114	0	0.876	1
RR Comm. 2020	Chrysta Castaneda	0.906	1	0.052	0	0.922	1	0.765	0.996	0.851	1	0.112	0
	James Wright	0.094	0	0.948	1	0.078	0	0.235	0.004	0.149	0	0.888	1
U.S. Senate 2020	John Cornyn	0.098	0	0.942	1	0.080	0	0.230	0.006	0.147	0	0.888	1
	MJ Hegar	0.902	1	0.058	0	0.920	1	0.770	0.994	0.853	1	0.112	0

Table 23: Brazoria results.

Finally, Brazoria results show a somewhat different pattern than the other county clusters: here, relatively higher uncertainty (confidence score below 90%) is found in Hispanic voting preferences from 2012 and 2014 (shaded in the table above). Since mid-decade, candidates of choice for all groups are extremely clear.

Among contests with at least 90% confidence score:

- **Black** support for D is at least 85%;

- **Latino** support for D is at least 73%;

- **Asian** support for D is at least 75%;

- **Other/White** support for R is at least 83%.

6.9 Turnout

Contest	Black est	Hisp est	Asian est	Other/White est
President 2016	.335	.223	.394	.540
RR Comm. 2016	.327	.191	.323	.521
Atty. General 2018	.291	.192	.483	.517
Comptroller 2018	.295	.184	.471	.509
Governor 2018	.293	.197	.483	.524
Land Comm. 2018	.296	.191	.473	.509
Lt. Governor 2018	.286	.193	.471	.522
RR Comm. 2018	.296	.189	.473	.509
U.S. Senate 2018	.296	.202	.509	.526
President 2020	.397	.282	.715	.693
RR Comm. 2020	.387	.260	.662	.667
U.S. Senate 2020	.387	.263	.692	.684

Table 24: Turnout estimates.

In Table 24, I report the EI-estimated turnout as a share of voting age population for each group. I have reported the numbers since 2016, since the 2012 and 2014 runs often had at least one group with a lower confidence score (under 90%) in the tables above. These turnout figures show consistently lower participation rates for the minority groups than for the Other (mostly White) adults in Texas, though Asian voters may be catching up with the majority group.[6]

As a check on the methodology, I have cross-referenced the Census Bureau publication entitled *Voting and Registration in the Election of November 2020* (Table P20).[7] These survey-based estimates were used to corroborate the participation gap observed in my EI-derived results: for instance, surveys report a double-digit gap in the rate of voting in the 2020 Presidential election between White voters and each other group, with the White–Hispanic gap coming in largest.[8]

This turnout gap may provide relevant evidence for the element of Senate Factor 5 that concerns "the extent to which minority group members bear the effects of discrimination in areas such as education, employment, and health, which hinder their ability to participate effectively in the political process."

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[6]I note that the turnout estimates produced by this method should be regarded as least certain for Asian voters, who represent the least numerous and least concentrated of the three minority groups.

[7]See www.census.gov/data/tables/time-series/demo/voting-and-registration/p20-585.html

[8]I have used this source to corroborate the gap, but I do not expect the numbers to closely agree, for several reasons. One is that the racial categories are constructed somewhat differently; the main reason is that the Current Population Survey, the data product from which this information is drawn, is based on self-reporting. It is well known in social science that survey methodologies tend to overestimate all groups' rates of voting. (See, for instance, Bernard Fraga's book *The Turnout Gap*).

7   Racial gerrymandering

Next, we shift away from the Section 2 context to examine constitutional claims of excessively race-conscious line-drawing in the clusters cited above, as well as a number of additional House districts.

I will use qualitative as well as quantitative assessments to illustrate the apparent predominance of racial considerations over traditional criteria. Several kinds of illustrative figures will accompany these discussions, including dot density diagrams (such as Figure 15), shaded diagrams called choropleths (such as Figure 16), and outlines comparing the enacted districts to corresponding districts from the benchmark plan (such as Figure 20).

In addition, I have employed state-of-the-art computational techniques to build randomized districting plans, amounting to 100,000 alternative plans in each district cluster. These *ensembles* of alternative plans are drawn with no use of race data whatsoever. The district generation algorithm enforces contiguity, places a high weight on compactness, and prioritizes the intactness of counties and county subdivisions. For more information on ensemble generation, see Appendix B. In this part of the current report, the role played by these ensembles is to illustrate, through the racial/demographic breakdown of the districts, that coalition population has been artificially elevated in certain districts and depressed in other districts, often in a characteristic *packing and cracking* pattern. The effect is often to pull the coalition CVAP share outside of the 40-60% range where the minority groups are likely to have strong influence or effective control of the district, without contributing to dilution overall. (See Figure 17 for an example.) The boxplots use a different column to record the range of demographic results observed in each district; in each generated plan, we order the districts from the lowest to the highest coalition CVAP share. The box shows the 25th–75th percentile range for CVAP, and the whiskers extend from the 1st to the 99th percentile. I have plotted the CVAP values for the enacted plan as blue dots in each boxplot; when the dot falls far outside the whiskers, this typically means that never in 100,000 random tries did the algorithm encounter a plan with this extreme of a demographic feature.

7.1   Congressional districts in Tarrant/Dallas (C1)

We begin with Cluster C1, which contains districts CD 6, 12, 24, 25, 30, 32, and 33 from the Tarrant/Dallas area. Of these, I will focus on CD 6 and CD 24, which are cited in the Texas NAACP complaint for potential racial gerrymandering.

CD 6   stretches through seven low-density counties (Cherokee, Anderson, part of Freestone, Navarro, Hill, Ellis, and part of Johnson) to extend a long finger northward through Tarrant and into Dallas County, winding through the cities of Mansfield, Arlington, Grand Prairie, Irving, and Dallas. (See Figure 2 for the full extent of the sprawl.) The district splits precincts to cut such a narrow band through Tarrant and Dallas. This design cracks a region with a significant share of POC voters in southeast Tarrant and northwest Dallas County across multiple districts.

CD 6 previously touched only Navarro, Ellis, and Tarrant Counties. The portion previously in Tarrant County was significantly more compact, covering much of the southeastern quadrant of the county. While the overall share of coalition VAP remained similar, the BVAP share was dropped from 20.7% to 13.5% as the shape was narrowed in a pattern that conspicuously excluded precincts with high Black population.

CD 24 is formed by a bulb in northeast Tarrant and a snaking path into Dallas. While the portion in Tarrant County remains relatively compact, the district meanders through Dallas County, splitting the cities of Irving, Farmers Branch, and Carrollton. Both Irving and Farmer's Branch have been the subject of previous Section 2 litigation. The design connects predominantly White communities in Tarrant to other White-majority areas in northern Dallas County. This weaving path unnecessarily fractures cities and breaks precincts, avoiding coalition population so that the neighboring districts become packed.

The skinny extension cuts through and divides an area with a large Asian population in northwest Dallas County. The district previously covered more geographic area in Tarrant County and maintained a more compact shape in Dallas County that preserved more cities. The benchmark plan's CD 24 had seen major growth in its coalition population, so that White residents had dropped below half of the voting age population. The new design aggressively reduced the coalition presence—Black-Latino-Asian CVAP was decreased from 40.8% to 25.5%, a difference of 15.3 percentage points. The shift from old to new is much starker on racial than on partisan grounds; the Biden share of the district drops by only 9.1 percentage points.
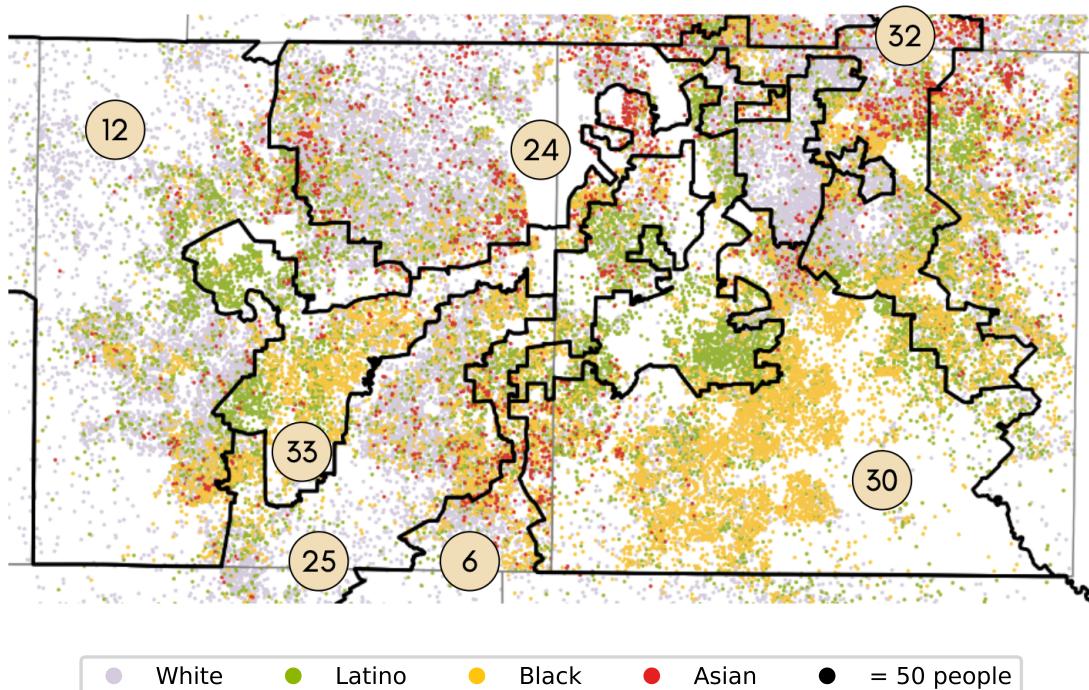
Figure 15: Congressional districts wind through minority communities throughout Tarrant and Dallas Counties. This plot illustrates that the poor compactness in the enacted plan is driven by intensely race-conscious boundary lines.

Estimated Coalition CVAP Share

0 — 10% | 10 — 20% | 20 — 30% | 30 — 40% | 40 — 50% | 50 — 60% | 60 — 70% | 70 — 80% | 80 — 90% | 90 — 100%
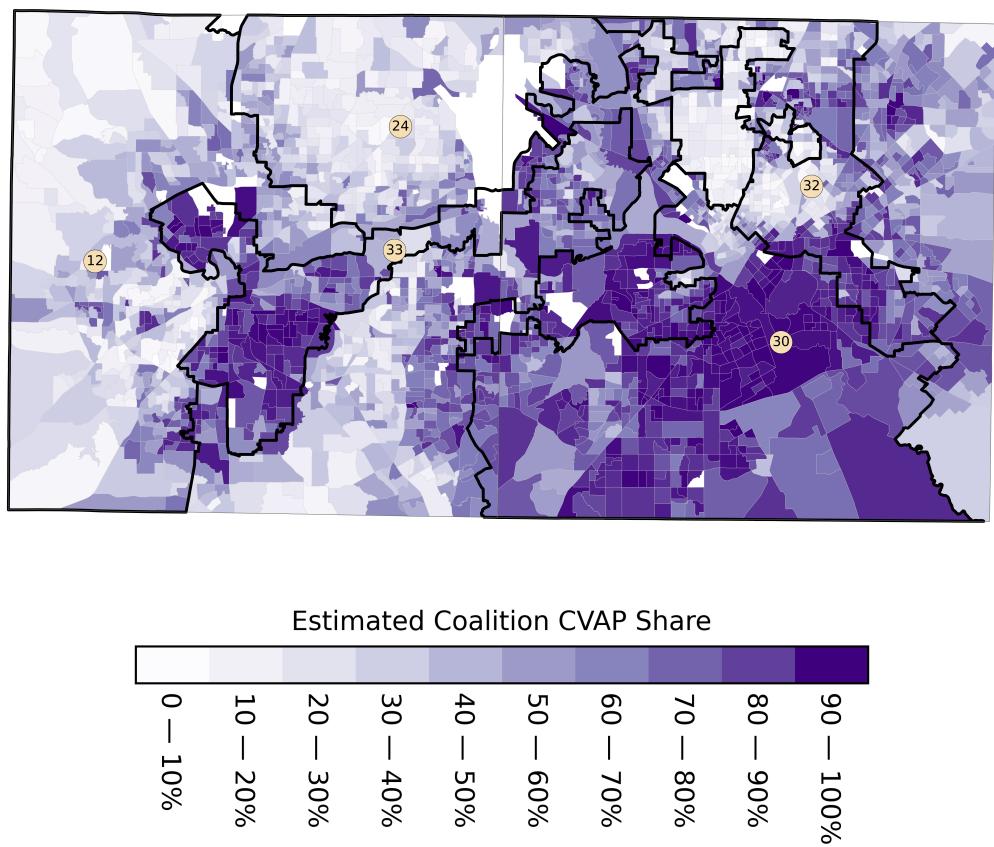
Figure 16: The careful exclusion of coalition population from CD 24 and the cracking of coalition communities by the skinny neck in CD 6 are easily visible in this choropleth.

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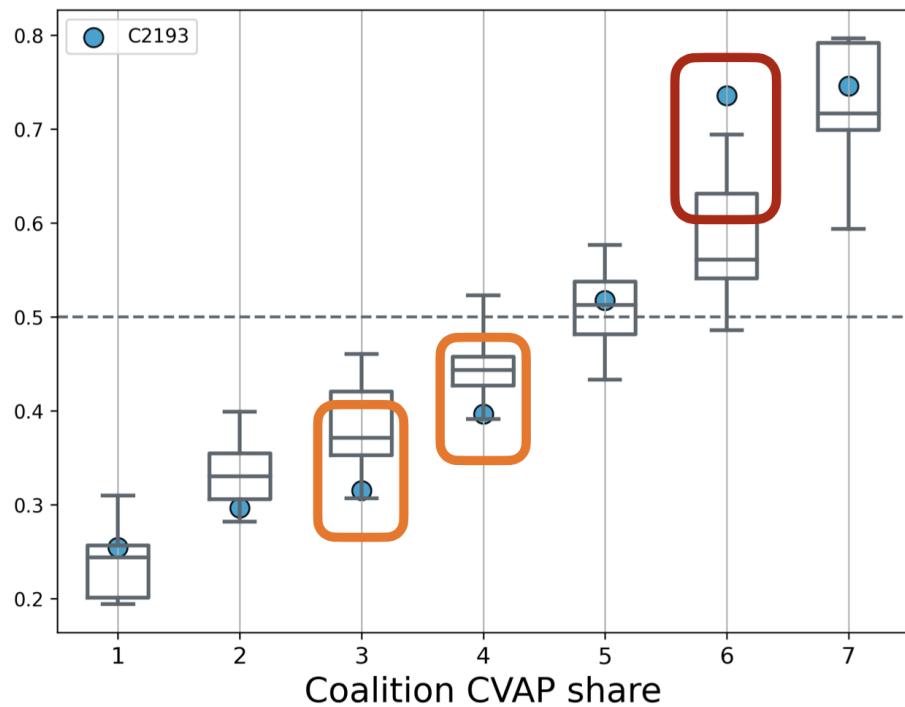
Figure 17: This boxplot shows that, relative to 100,000 randomly generated alternative plans, the state's map does not resemble race-blind alternatives. The enacted plan has a pattern of coalition CVAP that shows clear elevation in certain districts and depression in others, well beyond what the human geography would tend to produce. The districts in the 30-40% CVAP range (CD 12 and CD 6 in the state's plan) are lower than all but about 1% of the corresponding districts in the ensembles.

7.2 Congressional districts in Harris/Fort Bend (C2)

Cluster C2 includes eight districts (CD 2, 7, 9, 14, 18, 22, 29, and 38). Of these, there are racial gerrymandering complaints in CD 2, CD 22, and CD 38.

CD 2 has a boundary along CD 29 that appears to be excessively race-conscious, re-sulting in packing in CD 29.

Before redistricting, the coalition share of population in CD 2 had risen to 45.5%, enough for the district to verge on effective opportunity for coalition voters to elect can-didates of choice. The state's new lines pare that population back to 35.1%, maintaining control for White voters' preferences.

CD 22 starts in coastal Matagorda County before stretching inland into Wharton and grabbing portions of Fort Bend, Harris, and Brazoria Counties. In Fort Bend, the district splits into three non-compact spurs, interlocking jaggedly with adjacent districts 7 and 9. Together, the counties of Wharton, Matagorda, and Fort Bend are larger than one congressional district, so further splitting Brazoria and Harris Counties is not required to achieve population balance for CD 22.

The district unnecessarily splits Sugar Land, a diverse, plurality-Asian city with a total population of 111,026 (41% Asian, 38% White, 12% Latino, and 8% Black). The boundary with CD 7 divides this community, breaking precincts in the process. Other diverse cities like Manvel and Pearland were also needlessly split. The boundary with CD 9 appears to be surgically drawn with respect to Black voters, leaving many of the precincts with the largest share of Black voters from Fort Bend and Brazoria Counties to be added to CD 9 (whose overall coalition share of CVAP is over 85%). Meanwhile, CD 9 lost a signficant portion of its population base, which was placed in CD 18. And CD 18 lost its fifth ward and a nubmer of other communities of interest that were a core part of the district.

Previously, CD 22 was only located in Fort Bend, Brazoria, and a different portion of Harris County and the cities of Sugar Land, Manvel, and Pearland were intact. In the transition to the new lines, the overall share of coalition CVAP was dropped from 54.7% to 46.09%, with the clear implication of denying minority opportunity to elect. The minority areas removed from district 22 are split over five districts (7, 9, 14, 29, and 36), every one of which is either packed at over 60% coalition share or cracked at under 40% share.

CD 38 is new this year, as the Congressional apportionment for Texas was enlarged from 36 to 38 seats. The new district has a long, distorted hourglass shape that ap-pears to cut a narrow neck through more heavily minority areas in order to unite Whiter communities in its northern and southern lobes—from Harris County and a White area of west Houston. This contributes to packing in neighboring districts 8 to the west and 18 to the east of the "neck." Along the boundary to the south, CD 38 is drawn to selec-tively exclude precincts that have a relatively higher share of POC voters, contributing to packing in neighboring CD 7.
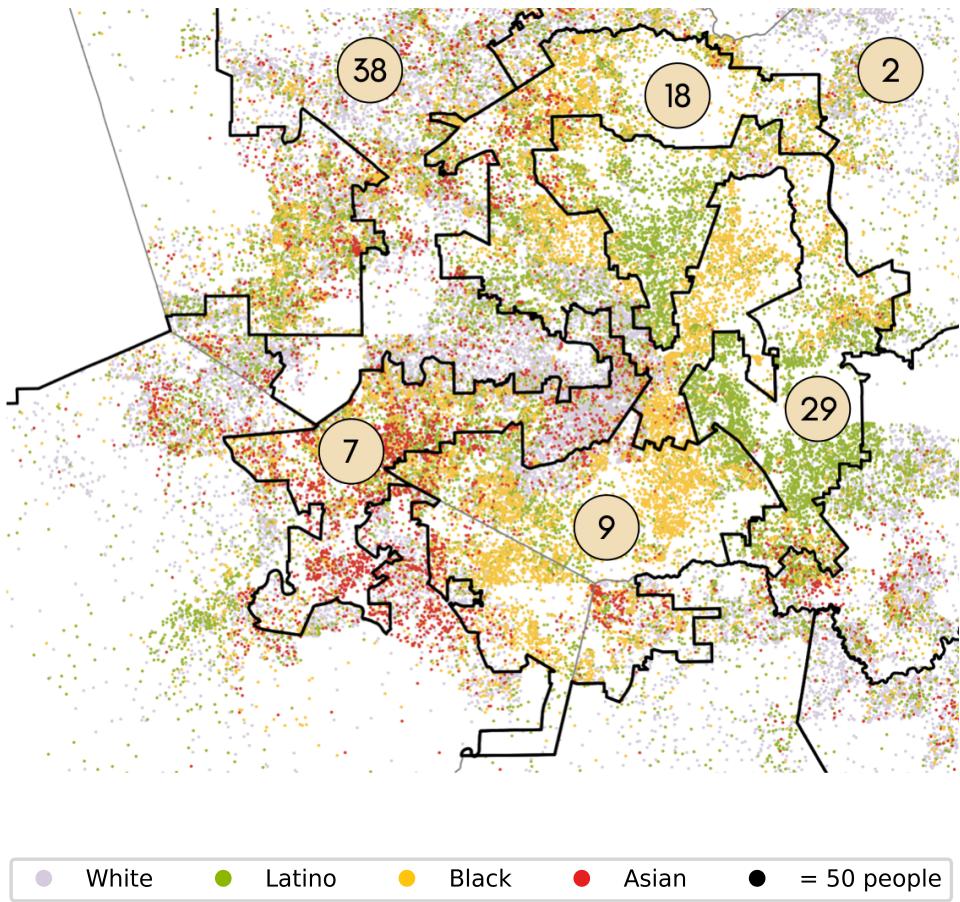
Figure 18: The Congressional cluster in Harris-Fort Bend. The concentrated Asian population in the Sugar Land area of Fort Bend County is split across four congressional districts.
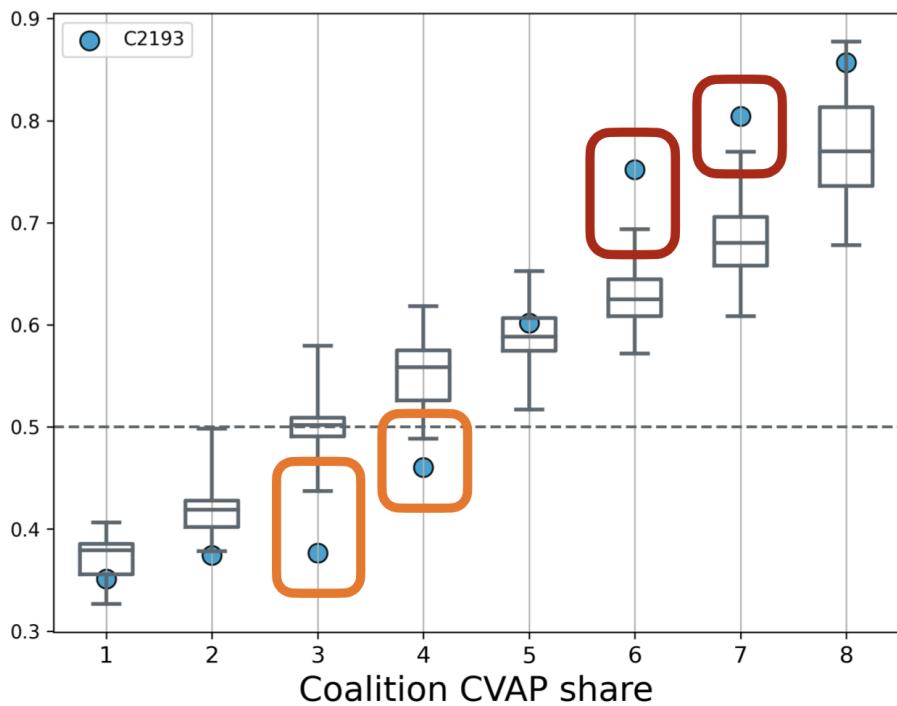
Figure 19: This boxplot shows that, relative to 100,000 randomly generated alternative plans, two districts have markedly elevated coalition CVAP, while two others are clearly depressed, likely costing coalition control of both districts. It is important to remember that the districts are interconnected; race-conscious decisions may include both packing and cracking in the same district, balancing out but contributing to the properties of the neighboring districts. Plots like this are intended to capture net effects.

7.3 Senate districts in Tarrant/Dallas (S1)

The S1 cluster includes seven districts (SD 9, 10, 12, 16, 22, 23, and 30). Of these, I will discuss SD 9, 10, and and 22 individually. I will also include a discussion of adjacent SD 2, even though it is not part of the Gingles 1 replacement map above.

SD 2   SD 2 is geographically comprised of a number of rural counties, as well as part of Dallas County and a small part of Collin County, touching seven counties overall. Latino voters are split along the border of SD 2 and SD 16. Despite the clear emphasis on county integrity in traditional redistricting in Texas, SD 2 traverses county lines so much that it has three geographically separate components in Dallas County.

SD 9   is completely contained within Tarrant County, but the city of Fort Worth is split between SD 9 and SD 10.
   The adjustment of district 9 from its pre-redistricting balance shows a much more pronounced racial than partisan differential: coalition CVAP was pared back from 44.4% to 35%, which put it likely out of reach for the minority candidate of choice. At the same time the Biden share fell by only 5.8 percentage points.

SD 10   now starts in Tarrant County and extends westward before taking a sharp south-ward turn at Shackelford County. This district, formerly contained entirely in Tarrant, now encompasses seven additional lower-density counties, which collectively serve to dilute the coalition presence considerably. From a pre-redistricting share of 47.1%, the coalition CVAP has been pared back to 38.1%. Fort Worth is sliced through important neighborhoods to accomplish this.
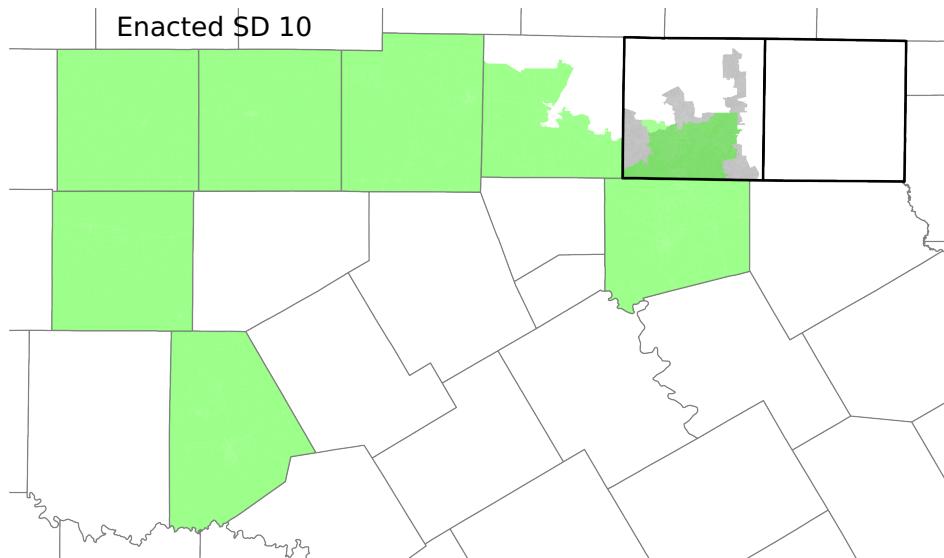
Figure 20: Gray shows the terrain covered by the benchmark district from the previous redistricting cycle, and green shows the newly enacted SD 10.

SD 22   dilutes a narrow chimney of urban population in Tarrant by combining it with nine entire low-density counties and part of Ellis County. A more intuitive and compact division of the terrain in the area might have kept this "chimney" with SD 10, while SD 22 would encompass Johnson County to the south. This would also provide significantly more opportunity for coalition voters, making the state's decision appear conspicuous. The City of Arlington, with population 394,266 and no single racial group above 35% of population, could easily be kept whole in a Senate district, but instead touches *four* districts, divided through the middle by district 22's northern limb. The boundary with district 10 neatly cleaves POC-majority precincts (kept in SD 22) from those with a White majority (pushed into SD 10).
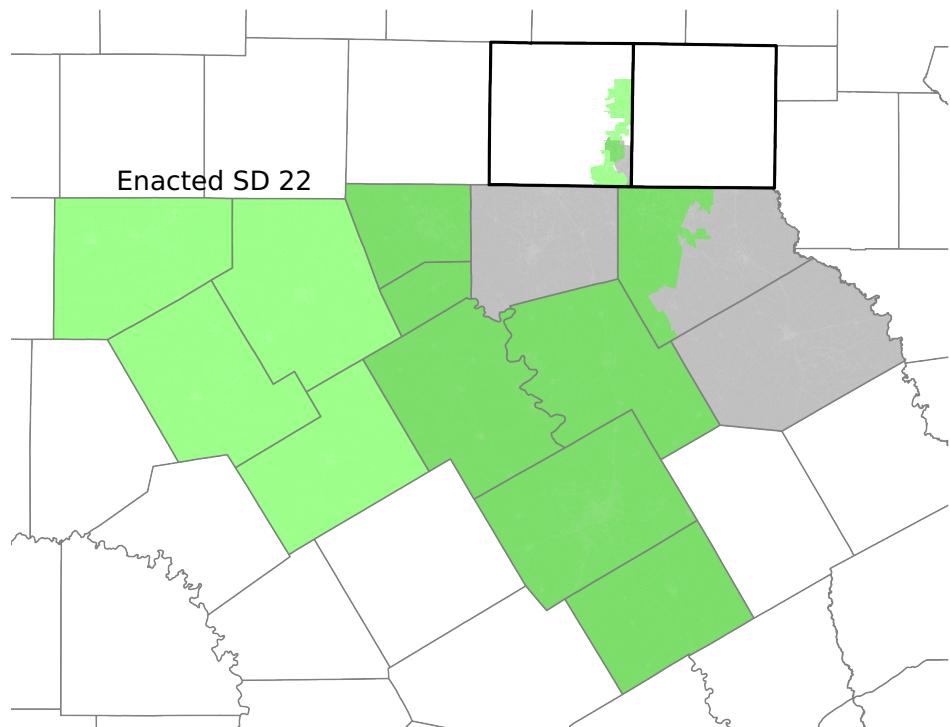
Figure 21: Gray shows the terrain covered by the benchmark district from the previous redistricting cycle, and green shows the newly enacted SD 22.

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Benchmark   Enacted (S2168)

Estimated Coalition CVAP Share
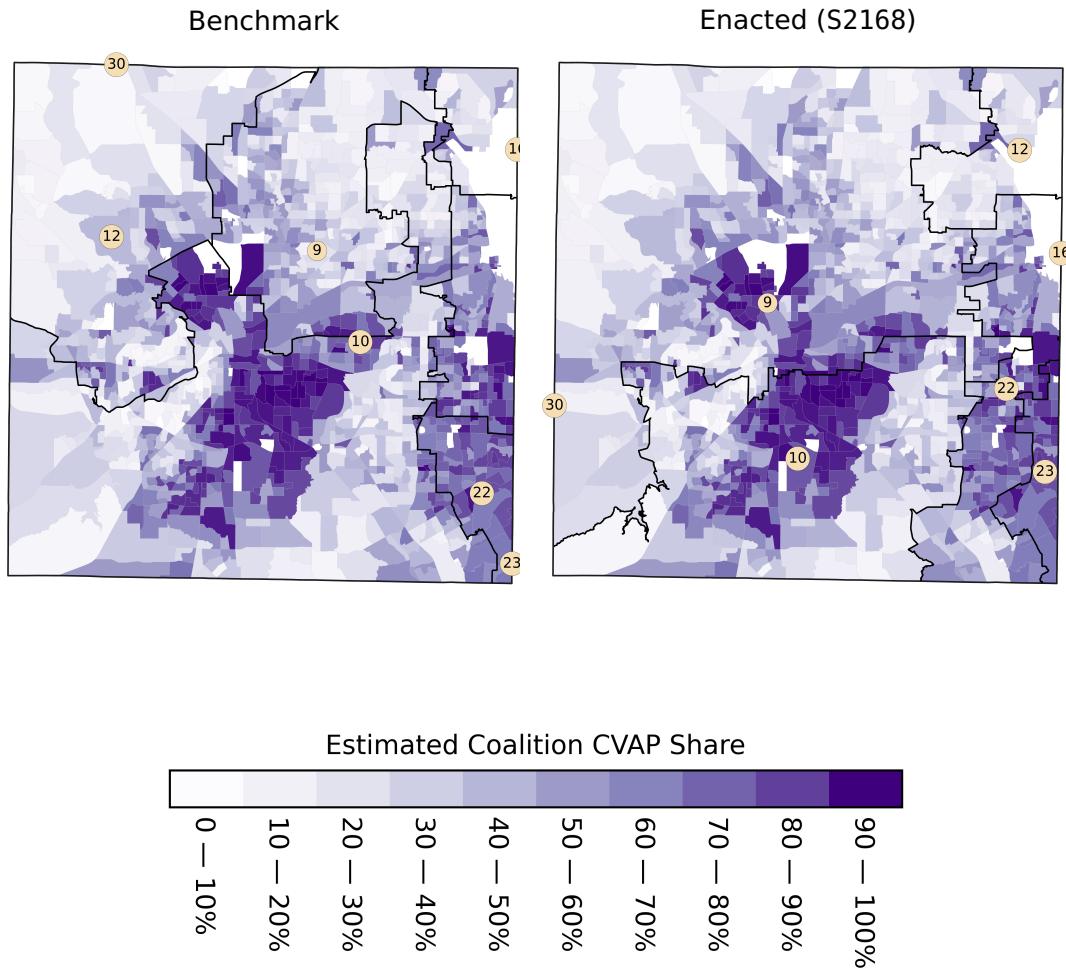
Figure 22: This pair of choropleths shows the POC population in Tarrant County in partic-
ular, with two visible concentrations that were previously together in SD 10—the North-
east/Northside neighborhoods of Fort Worth on one hand and Southeast/Sycamore neigh-
borhoods on the other—now split between SD 9 and SD 10. In the southeastern corner,
minority communities in Arlington and Mansfield are now cracked by a narrow corridor
of SD 22.
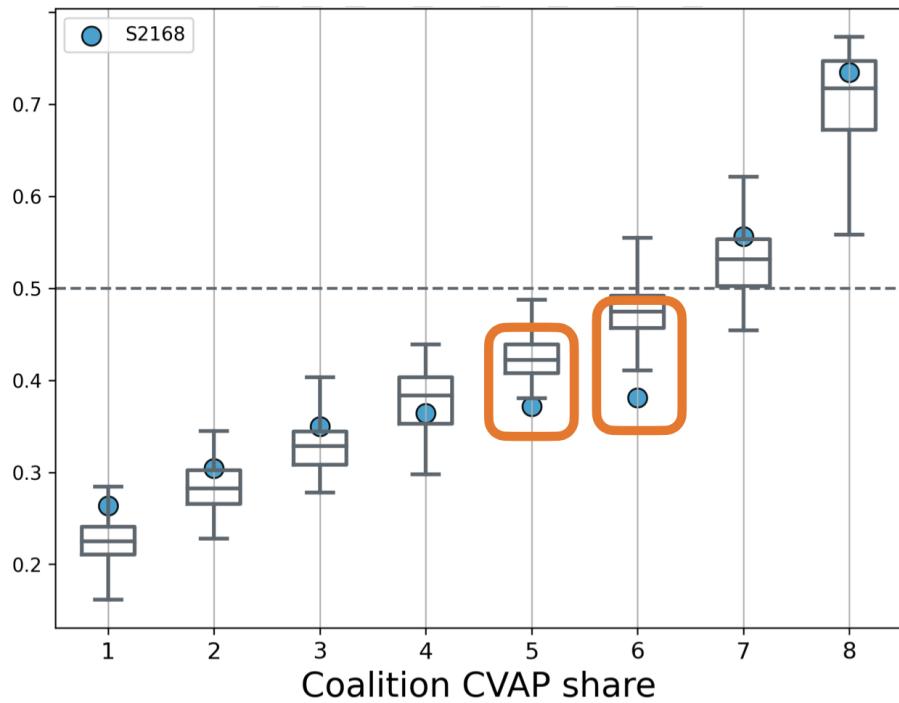
Figure 23: Relative to 100,000 randomly generated alternative plans that take the human and physical geography into account, two districts have conspicuously lower coalition CVAP. This likely costs electoral influence for minority groups, and is not explained by the neutral criteria. The ledge below 40% coalition CVAP is suggestive of dilutive intent.

7.4 Senate districts around Fort Bend (S2)

The S2 cluster includes five districts (SD 6, 13, 15, 17, and 18). The complaint makes racial gerrymandering claims in three of these: SD 15, 17, and 18.
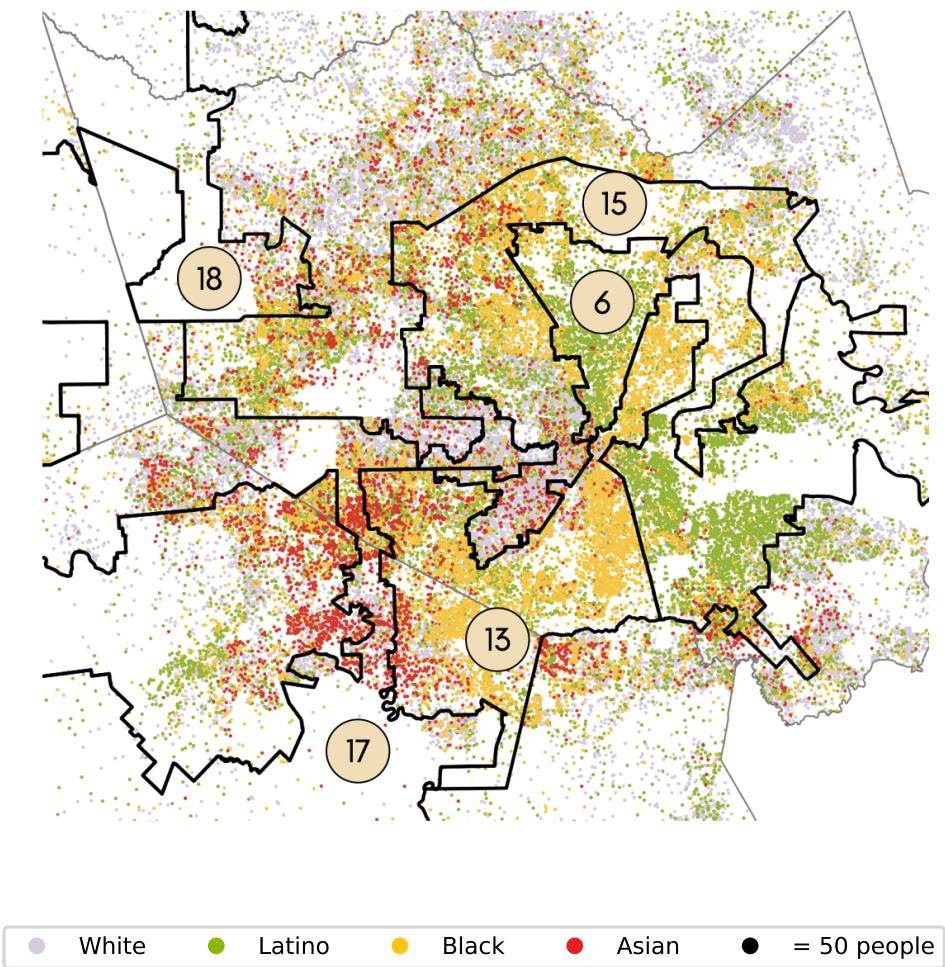
Figure 24: The lines are exceedingly race-conscious, appearing as race-sorted pie slices in the dot density map shown here. The effect is highly dilutive.

SD 15 is a non-compact, arching district that includes a portion of the city of Houston proper and wraps around exurban Houston. This and its interlocking neighbor SD 6 are the two least compact districts in the entire Senate map, by the Polsby-Popper metric, with strikingly low scores of about 0.07. They carefully split population so that Hispanic voters are kept in SD 6, which is packed at 82% coalition CVAP.

SD 17 starts with low-density coastal counties but extends an antler shape into Fort Bend, Harris, and Waller Counties. The "antlers" split the city of Sugar Land and crack other areas with significant POC share. Before re-drawing, this district sat at 48.4% coalition CVAP, but the new design reduces that number to 43%.

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SD 18 combines minority population with extremely polarized White bloc voters, creating a district safely out of reach for its coalition voters. From numbers alone, this district's 49.55% coalition CVAP share looks like it might be at or near an opportunity zone for minority voters, but by dodging around Brazos County (home to College Station and Texas A&M University), the district conspicuously avoids the White population that is most likely to cross over to support POC-preferred candidates.
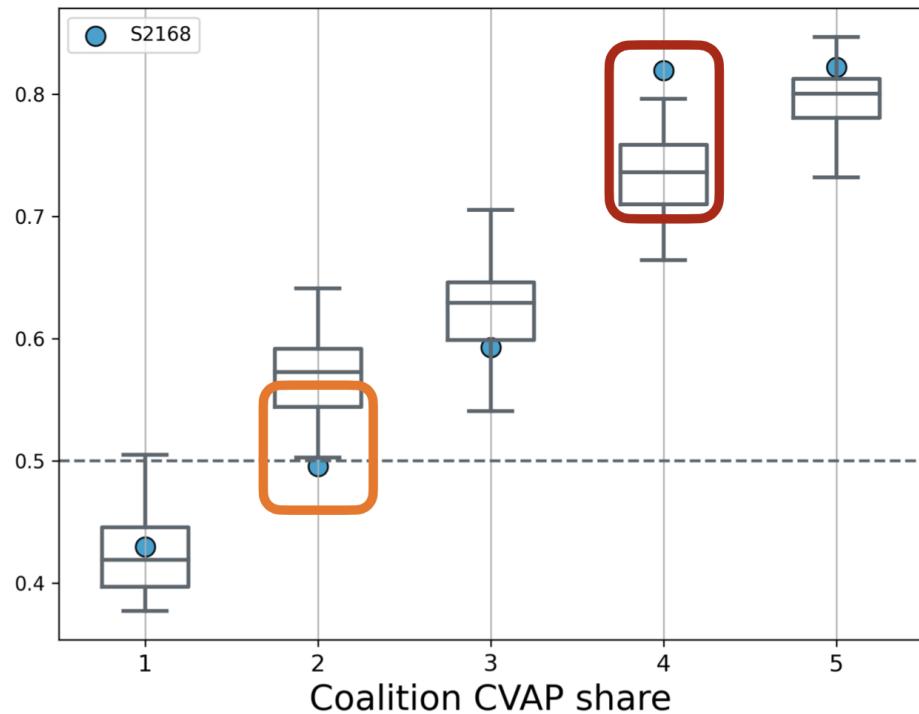
Figure 25: Relative to 100,000 randomly generated alternative plans, the state's map once again displays a characteristic pattern of unusual demographics. The elevated share of coalition CVAP in one district is compensated by a notably depressed share in another, likely costing minority opportunity to elect in SD 18.

7.5   House districts in Tarrant (H1)

H1 is a large cluster of House districts containing HD 90-99 and 101. Of these, I will look at racial gerrymandering indicators in HD 93, 94, 96, and 97.

The diverse City of Arlington (pop. 394,266) was already discussed above, in Senate cluster S1. It is cracked in the House map as well, with parts included in each of five districts in the state's map.
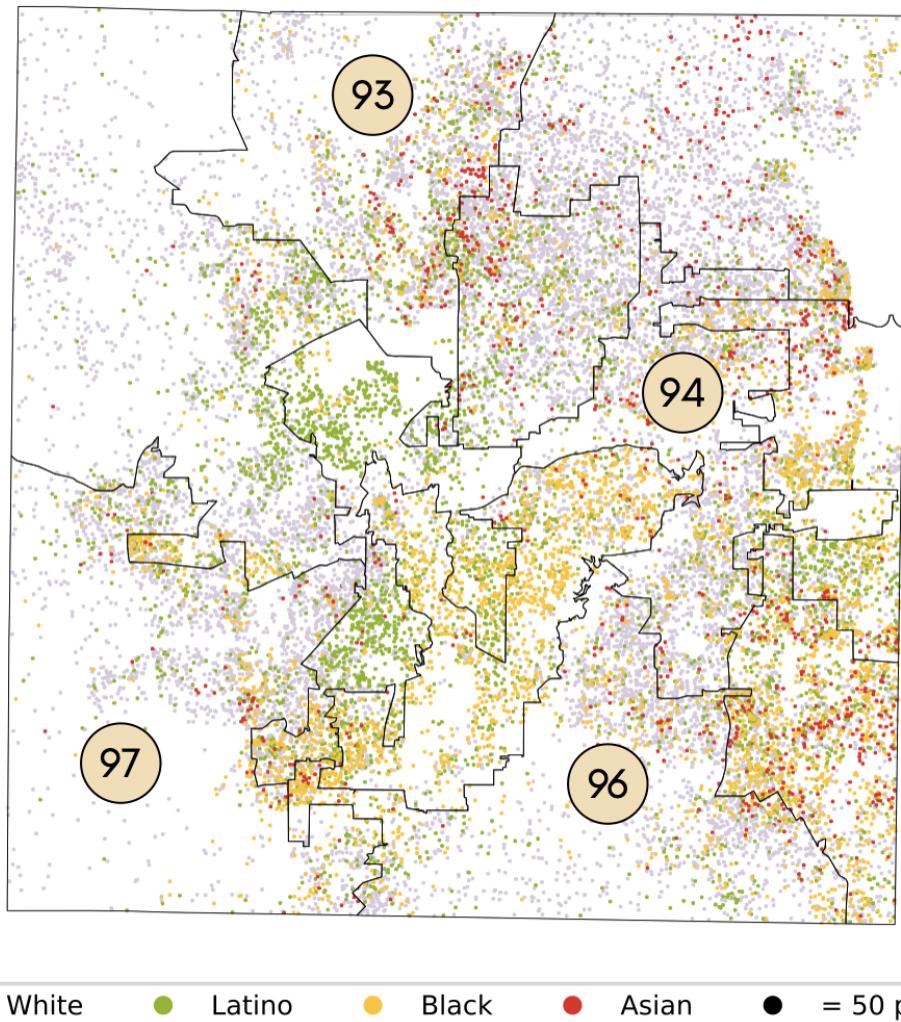
Figure 26: Packing and cracking is clearly visible in the House plan within Tarrant County.

HD 94 dodges concentrations of minority population in every direction. It is built from part of Fort Worth, part of Arlington, and a number of small, heavily White suburbs and enclaves (like Dalworthington Gardens, Pantego, Hurst, and Bedford). This design sacrifices the predecessor district's compactness, and ensures a coalition CVAP share of under 32%, making the district far Whiter than the county as a whole.

HD 96 also contains pieces of both Arlington and Fort Worth, A forking tail to the west picks up two precincts in Fort Worth that are heavily Black. The net change in CVAP with the new lines amounts to −8.3% coalition CVAP, and −5.6% Biden share—a heavier demographic than partisan differential. This brings the district down from 44.4% to 36.1% coalition CVAP. The terrain removed from the district is divided up among districts 90, 95, 97, 101—all ending up with coalition CVAP shares below 30% or over 65%.

HD 97 had both its coalition share and its Biden support share drop by about 5 per-centage points in the redistricting process. Pockets of concentrated minority population were carved out, such as a rectangle of three precincts with a Black and Latino majority in the Western Hills neighborhood of Fort Worth that was present in the benchmark HD 97 but stripped out of the re-drawn district. This suggests at a minimum that race was used as a heavy proxy in the targeting of this district.
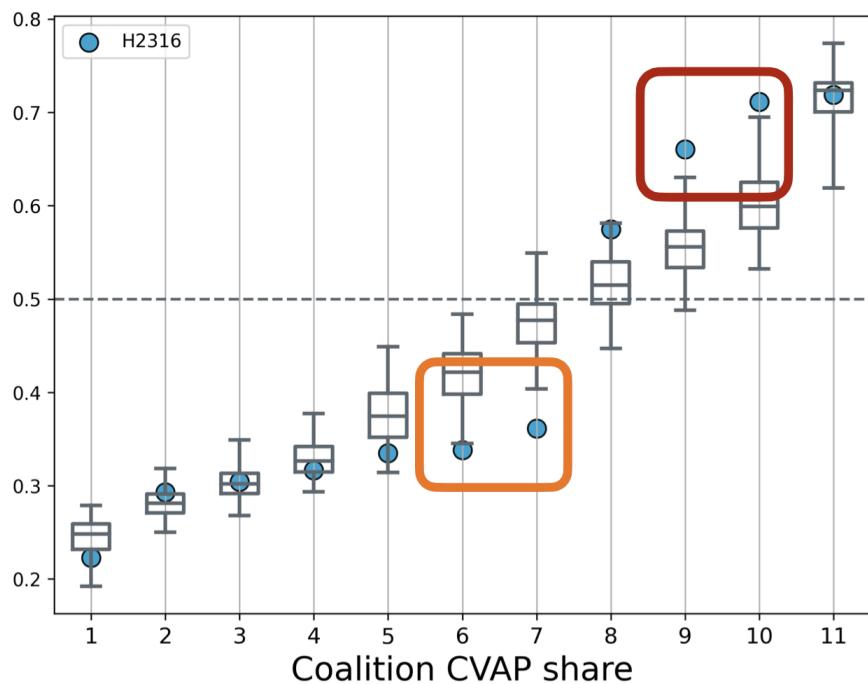
Figure 27: Relative to 100,000 randomly generated alternative plans, the state's map shows the same distinctive pattern of demographic manipulation found in other clusters. Two districts have have a pronounced elevation in their coalition CVAP; on the other hand, the CVAP is conspicuously low in two others, pushing them below the range of likely opportunity or influence.

7.6   House districts in Dallas (H2)

The H2 cluster contains HD 100, 102-105, and 108-115. The complaint alleges racial gerrymandering in two of these districts: HD 108 and HD 112, both carefully arranged to include Whiter precincts and exclude those with more coalition population share.

HD 108   is highly non-compact; between them, districts 108 and 114 neatly cover the majority-White precincts in North Dallas. Along all of the other shared boundaries of HD 108, the WCVAP differential across the district boundary is roughly 20 percentage points—a manifestly race-conscious line.

HD 112   hugs the northeast outer boundary of Dallas County, including the most heavily White precincts to secure its overall 33.3% coalition CVAP share—an extremely steep dropoff from the benchmark district, whose coalition population had grown to 51.8% of CVAP. This drop of 18.5 percentage points is not close to matched by the partisan shift, where the Biden support share drops by under 5 points.

   In the process, the significant Asian population of Garland, Sachse, and Rowlett is cracked—split across districts 112, 102, and 113.
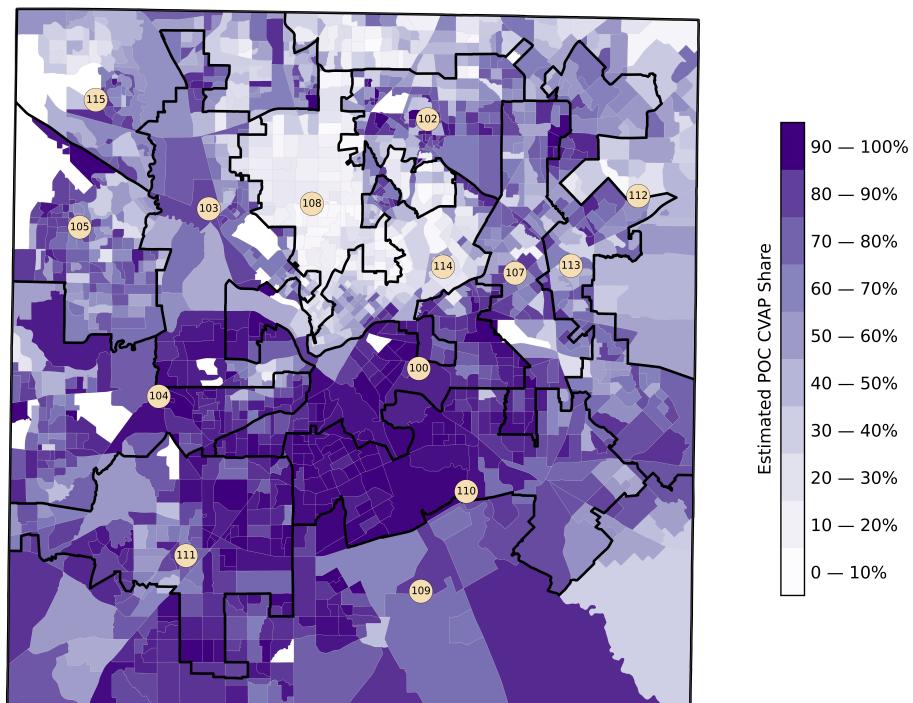
Figure 28: House districts 108 and 112 are carefully arranged to retain White majorities.
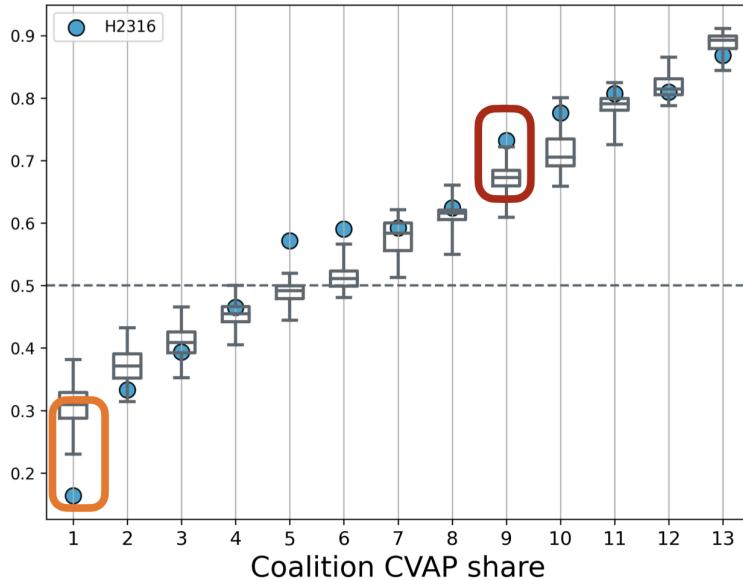
Figure 29: Against these 100,000 randomly generated alternative plans, we see a familiar pattern in the enacted plan. In particular, one district (HD 108) has a far lower coalition share than is ever observed in the ensemble.

7.7 House districts in Denton/Wise (H3)

The Denton/Wise cluster contains five House districts (HD 57, 63, 64, 65, and 106). These work together to break up the concentrated coalition population in the southeastern corner of Denton County.

HD 57 is an elongated barbell-shaped district with a narrow neck avoiding the City of Denton.

HD 63 is one of three House districts—63, 65, and 106—dividing up Lewisville, a majority-minority city of population 111,822 in southern Denton County. The state's arrangement keeps all three districts under 35% coalition CVAP, while the city itself has over 62.5% coalition share.

HD 65 is now a very narrow district that spans Denton County from East to West, diluting communities of color in the southeastern part of the county, where it is part of the three-way cracking of Lewisville/Carrollton.
    It is quite clear that this was an express design decision. The benchmark plan had its district 65 compactly located in the southeastern corner of the county, with the Black-Hispanic-Asian coalition forming over 45% of CVAP. In 2018, the district elected progressive Democrat Michelle Beckley to the state House with the strong support of people of color, and in 2020 she was narrowly re-elected. The new arching design drops that coalition CVAP number by over ten percentage points.

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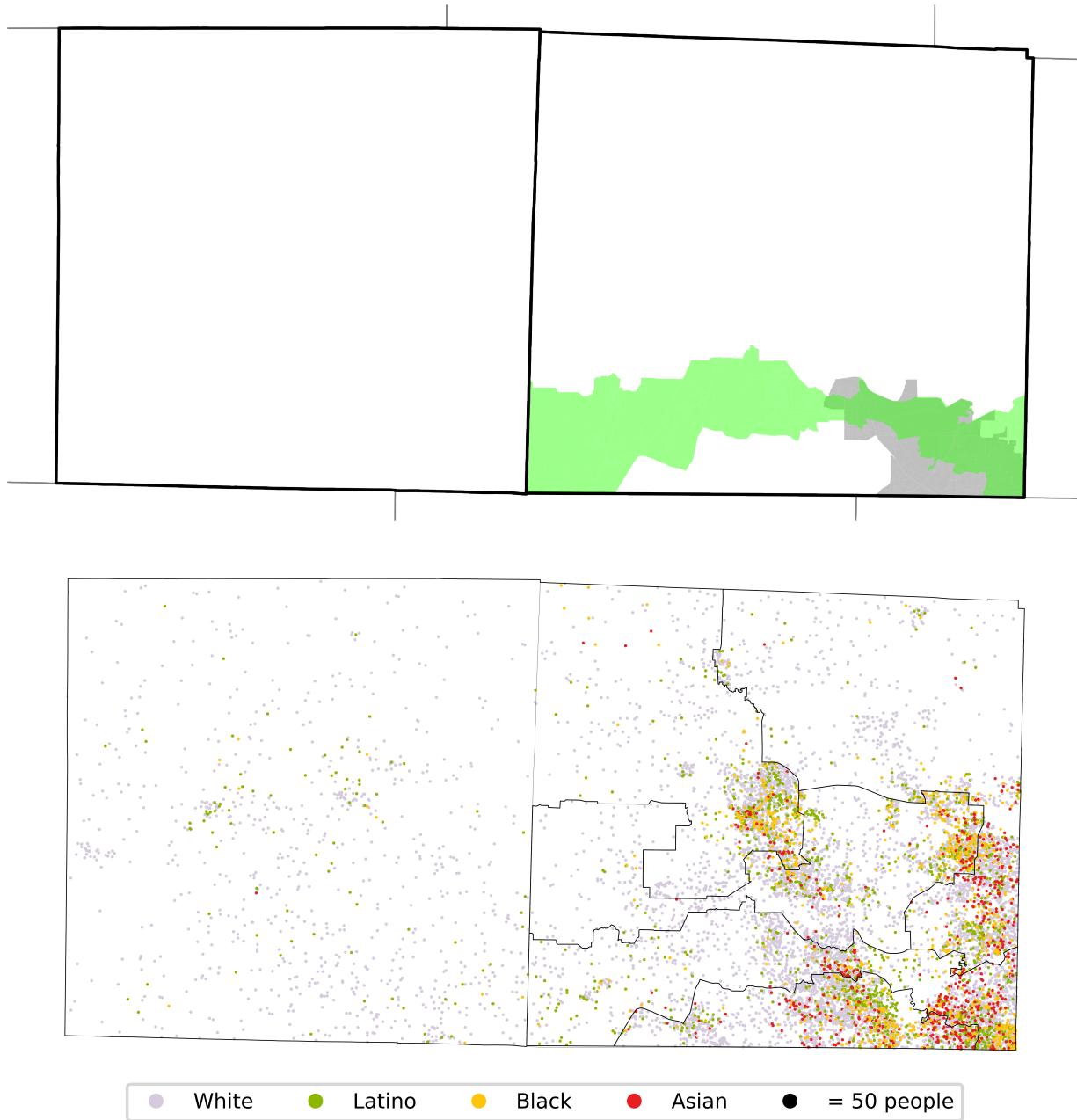
Figure 30: The multi-racial concentrations of population in Lewisville/Carrollton, seen in the southeastern portion of Denton County, are split across three districts in the state's House plan. The more compact benchmark HD 65 had a near-majority of coalition CVAP before being replaced by the new, arching design.
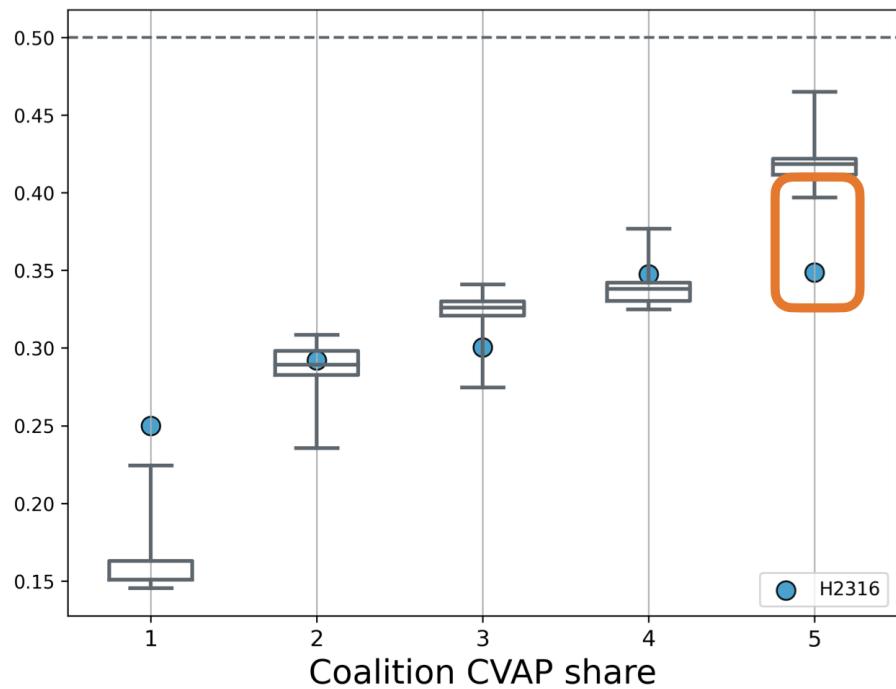
Figure 31: In every single one of 100,000 alternative plans drawn pursuant to the rules and priorities of Texas redistricting, minority coalition voters would be present in far greater numbers in at least one district.

7.8 Brazoria

HD 25 and HD 29 together make up the whole of Brazoria County. The dividing line is drawn to keep them both majority-White by CVAP, whereas the benchmark plan had 29 as a majority-coalition district. That dividing line unnecessarily splits precincts along its whole length, while cracking Hispanic and Black communities in the cities of Pearland, Manvel, Iowa Colony, Richwood, and Freeport. Despite the fact that most of Brazoria is unincorporated, the district line cleaves each of these cities.
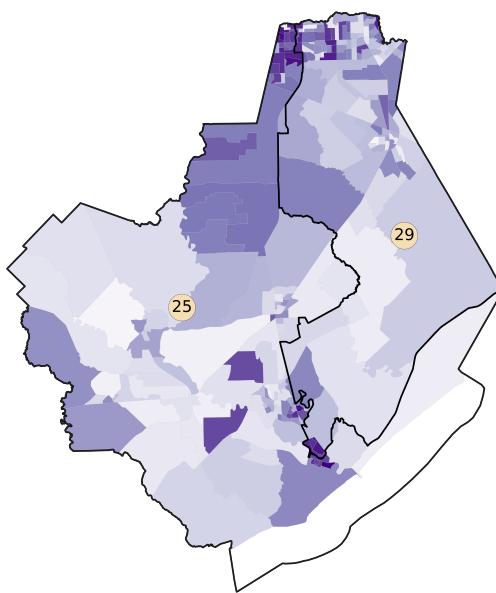
Figure 32: Though the line could have been drawn anywhere in Brazoria County, it splits right through concentrations of coalition population.
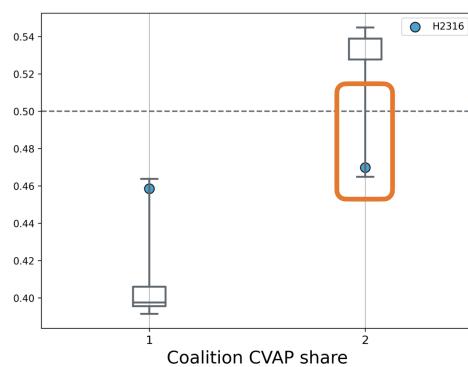
Figure 33: Though the vast majority of plans in Brazoria county that follow traditional districting principles would include a majority-coalition district, the state has selected a plan that does not.

7.9 Other House districts

Beyond the four House clusters, we will also consider signs of racial gerrymandering in districts HD 26, 54, 66, 67, 121, 126, and 132.

HD 26 is in northern Fort Bend County, containing the cities of Pecan Grove and Richmond, together with shards of Houston's municipal sprawl. On its southern end, this district splits the majority-Latino City of Rosenberg. HD 26 saw fairly drastic reconfiguration from the benchmark plan to the new enacted plan, staying about equally non-compact but shedding minority population to drop the coalition share of CVAP from 55.6% to 45.8%.
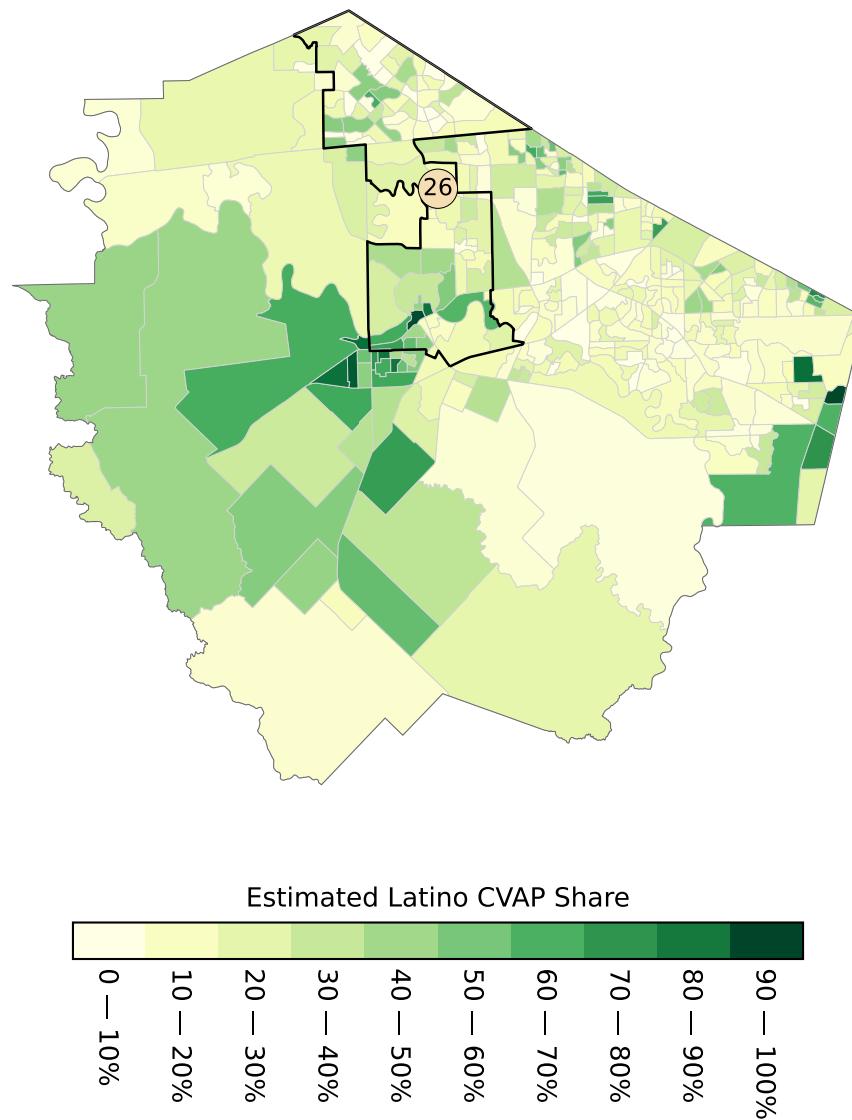
Figure 34: HD 26 cracks Latino areas of Rosenberg at its southern tip.

HD 54 is a donut shape that completely encloses HD 55, together making up all of Bell County. This highly unconventional donut-hole configuration is new in this redistricting; previously, district 54 covered the western part of Bell County and all of neighboring Lampasas County. The county is very nearly 50-50 White and POC CVAP, but the district line cuts the plurality-Black City of Killeen, splitting precincts only there and in no other part of the county. It is notable that the new design needlessly splits the largest city in the county—at population 153,095, Killeen could quite reasonably have been the anchor of its own House district (ideal population 194,303). The redraw also took a district which, in its benchmark configuration, had risen to have 53.4% coalition CVAP, and shaved that back to 50.6%.
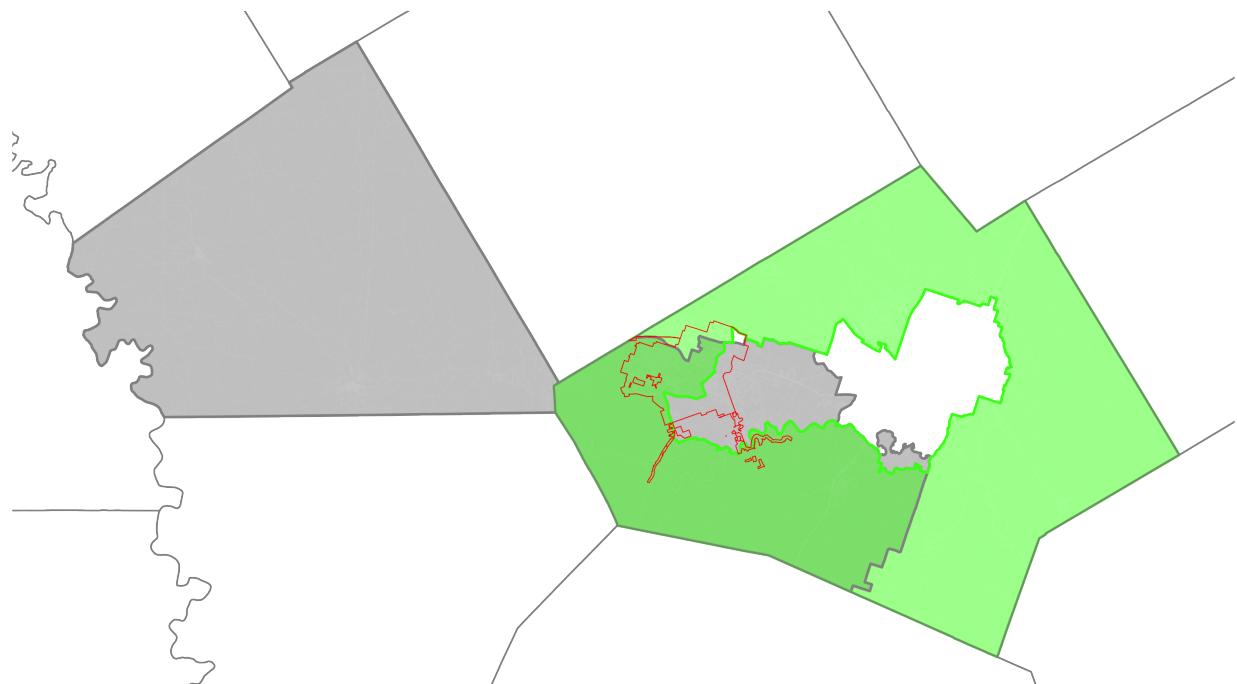
Figure 35: HD 54, before (gray) and after (green), with the city of Killeen outlined in red.

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HD 66 and HD 67   in Collin County were entirely reconfigured from compact neighbors in the southwestern corner of the county (see Figure 37) to long, non-compact tranches that contribute to a clear pattern of cracking. That is because Collin County overall has roughly 1/3 coalition CVAP, and every one of the six House districts that touches the county (33, 61, 66, 67, 70, and 89) is designed to maintain a similar proportion to the county as a whole. Thus while there is more than enough Black, Latino, and Asian population to control one or more districts in the county, the new districts are drawn in a way that blocks opportunity to elect.

The cracking can be acutely observed in the southwestern portion of the county, where adjoining cities of Plano, Frisco, and Allen collectively have Asian American/Pacific Islander residents making up over a quarter of the population—one of the highest concentrations of Asian residents in the state. The state's plan splits each of these three modestly-sized cities across at least three and up to five House districts, with none of those districts exceeding 13% ACVAP.

White   ●   Latino   ●   Black   ●   Asian   ●   = 50 people
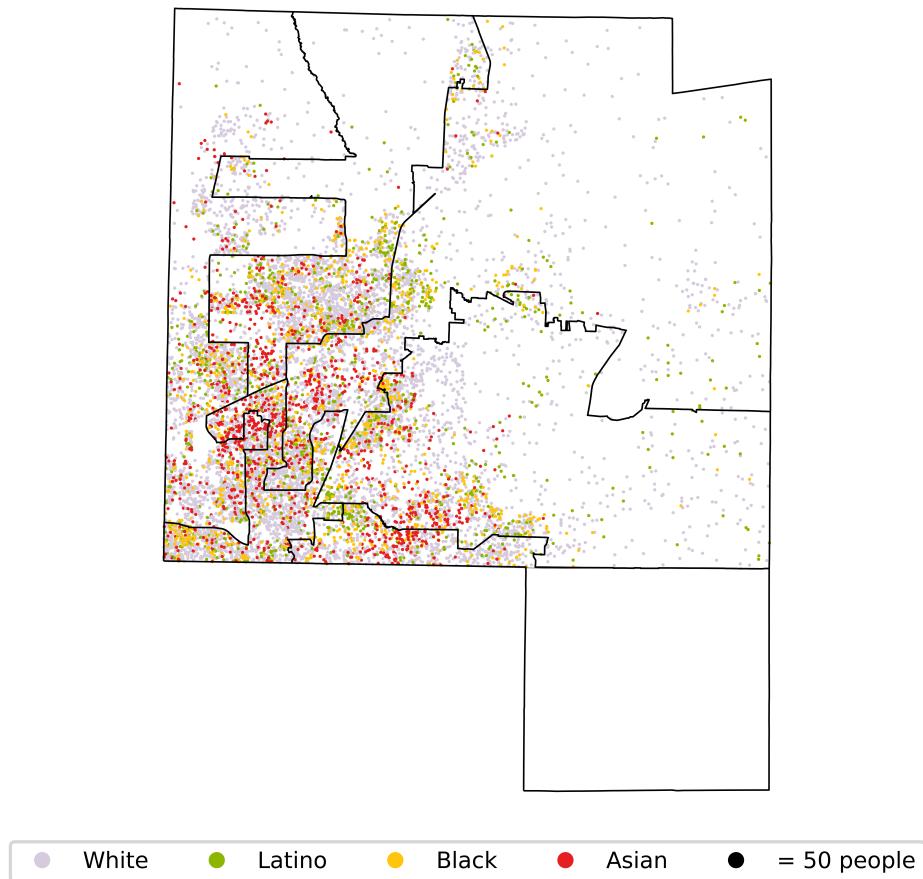
Figure 36: Geographically extended districts 66 and 67 take slices of urban population and dilute the coalition share with Whiter rural population.
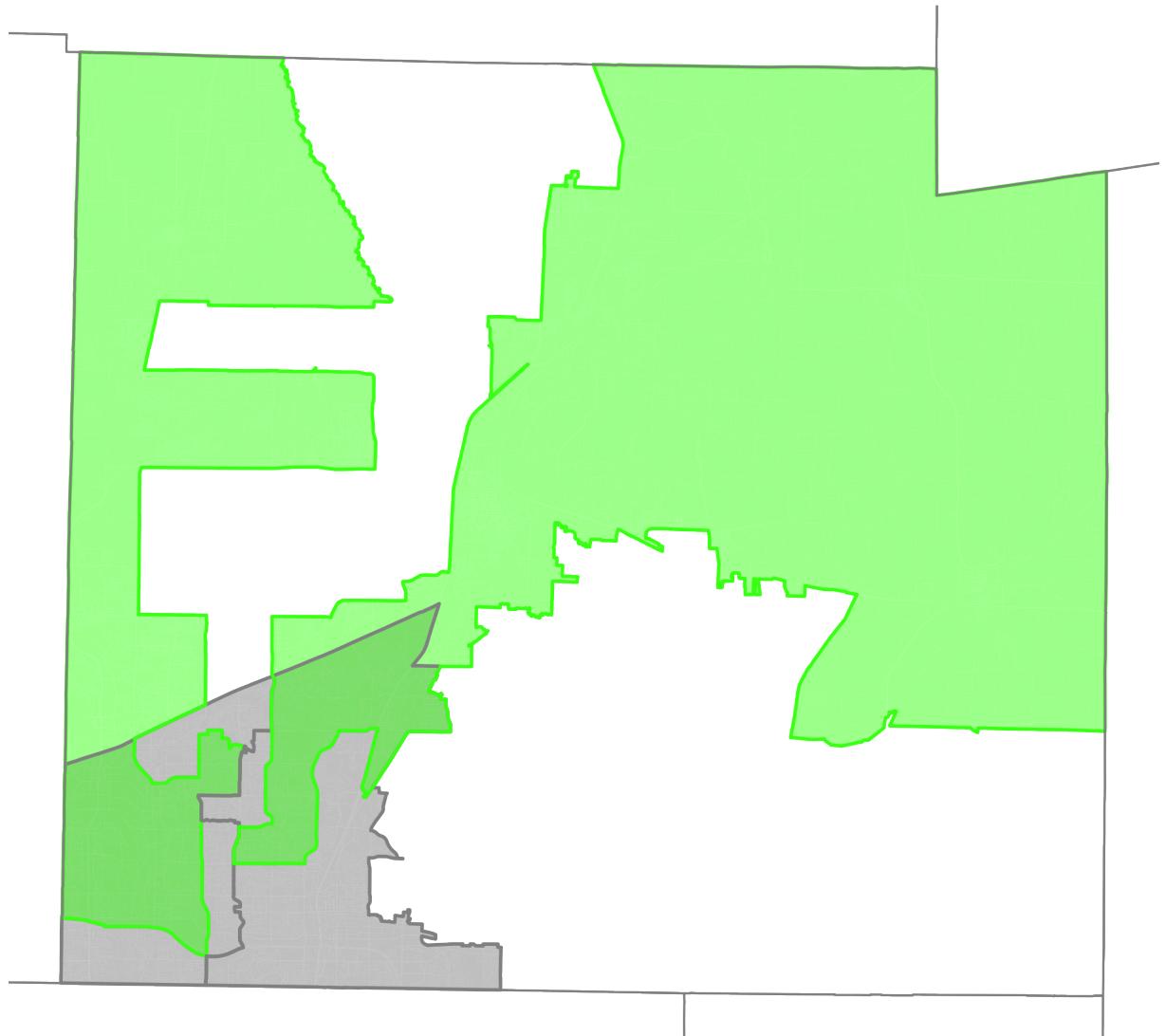
Figure 37: HD 66 and HD 67, before (gray) and after (green).

HD 121 in Bexar County has a non-compact shape along a jagged border shared with HD 123 within the City of San Antonio—for instance, HD 121 swivels to avoid a Latino community in the Northeast Park neighborhood, near the airport, leaving it to contribute to packed district 123 (63% Hispanic CVAP). To the south, the contours of HD 121 are clearly defined by tracing along the heavily White suburbs of Terrell Hills, Alamo Heights, and Olmos Park. The net effect of the racially-precise lines is a coalition CVAP share that is diminished from the benchmark, now coming in at 42.3% overall.
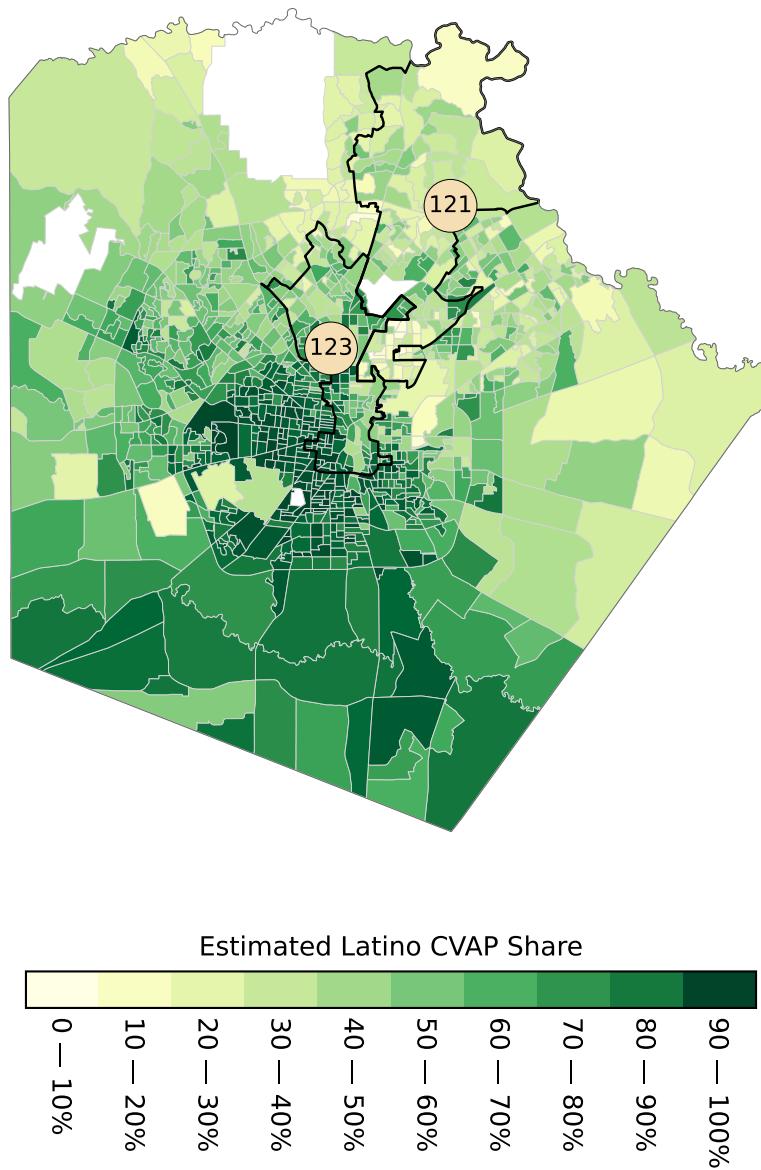
Figure 38: Excessively race-conscious lines draw Latino residents out of HD 121 and into packed HD 123.

HD 126   is located at the northern end of Houston's urban sprawl, within Harris County. In the process of drawing new districts, its coalition CVAP was dropped from 55.6% share to 44.9%, a much more pronounced shift than its partisan balance. The territory that was shed in the reconfiguration, itself with a 77% coalition CVAP share, was relocated into neighboring districts 139 and 148, both with roughly 70-80% coalition CVAP share.

HD 132   sits within Harris County, including shards of Houston and coming to a point, new in this redistricting, within the small City of Waller. Its coalition CVAP follows the pattern we have seen throughout this section, having crept up to 53.6% share at redistricting time and now steeply dropped to 41%. The excluded territory, with significant concentrations of both Black and Latino Texans, was redistributed entirely to neighboring districts 135 and 149, both at roughly 70-80% coalition CVAP, once again.
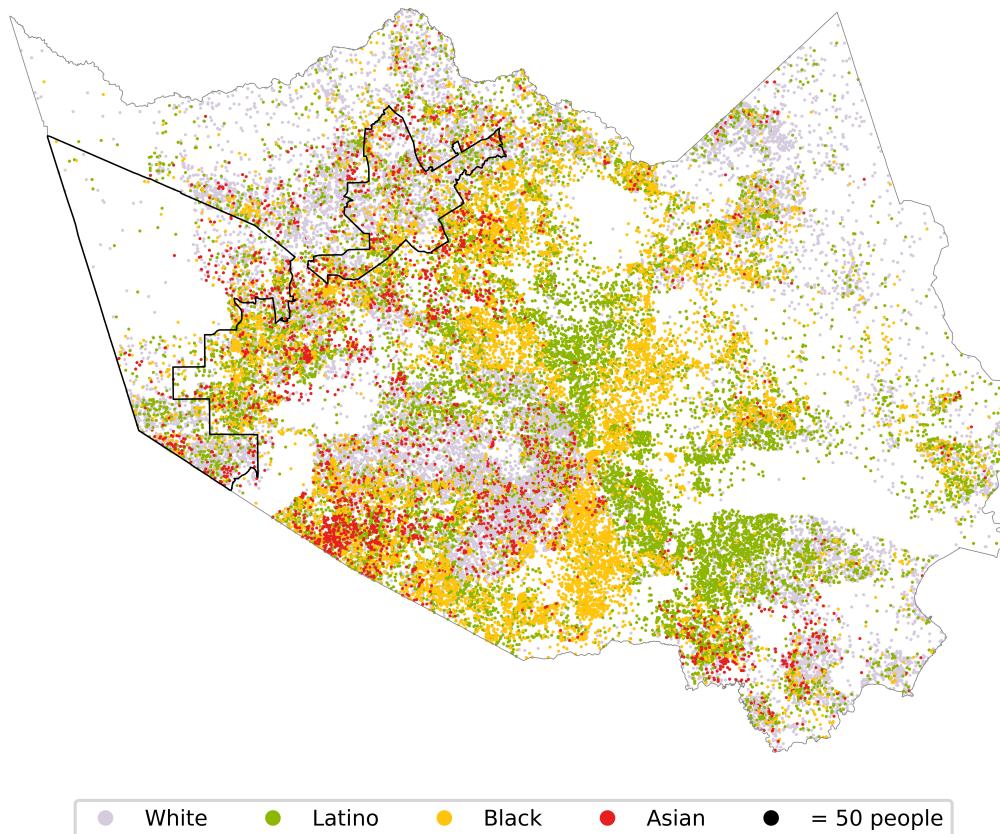

Figure 39: Districts 126 and 132 are drawn to neatly dodge pockets of coalition population.

7.10   Summary of ensemble evidence
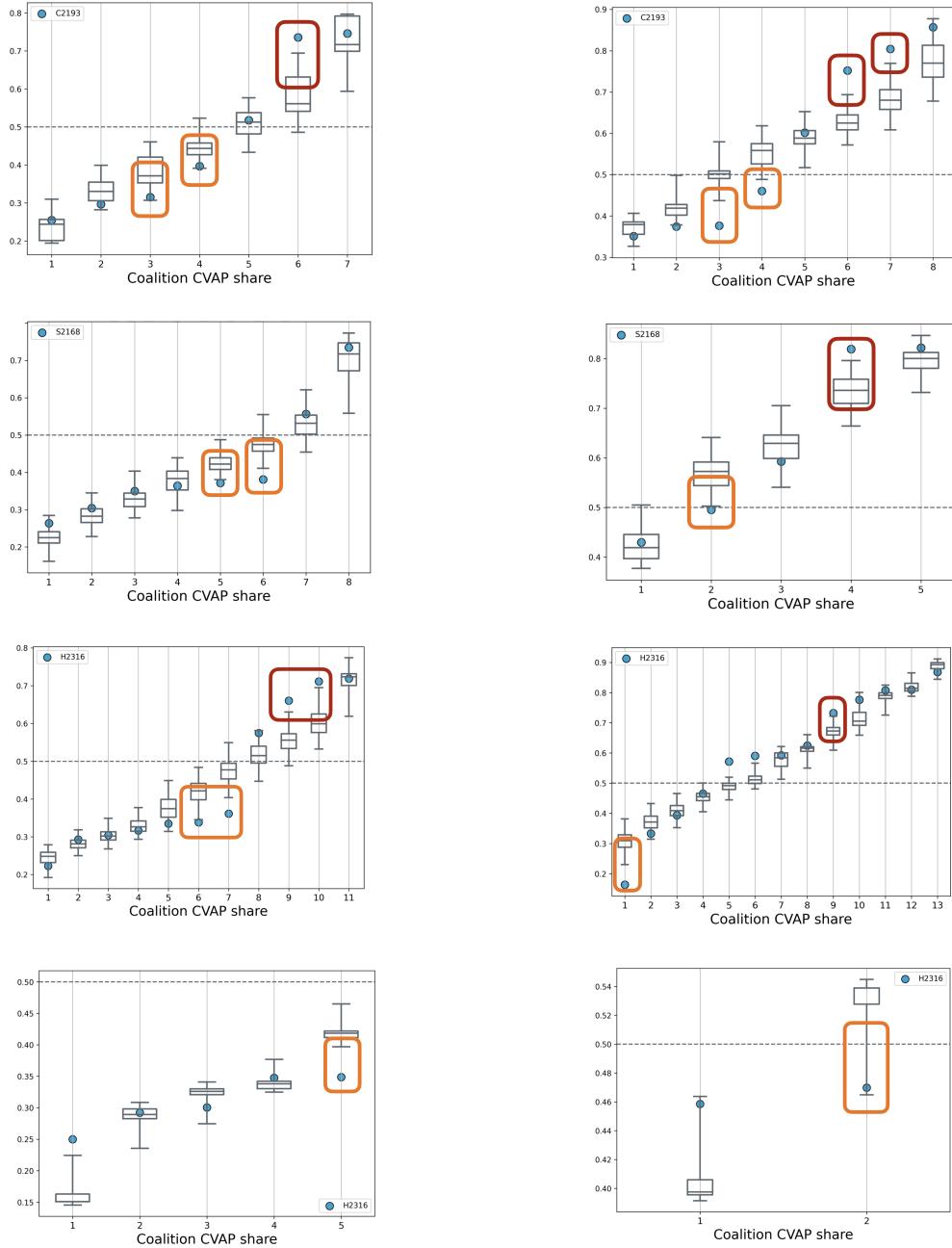
Figure 40: Across the eight clusters discussed above, a consistent pattern can be observed. The demographic composition of these clusters is interconnected, and the elevated coalition CVAP in some districts is entwined with targeted decisions that cost opportunity elsewhere.

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8 Conclusion

This report contains a methodical treatment of Gingles 1 (§5), Gingles 2-3 (§6), and constitutional considerations of racial gerrymandering (§7) in a subset of the Texas electoral districts recently enacted by the state for Congress, state Senate, and state House.

The alternative plans proposed for Gingles 1 purposes are intentionally modular, redrawing precisely the same terrain covered by clusters of districts in the respective enacted plans. This allows for the alternatives to be considered in a mix-and-match fashion, with impacts that are regionally contained.

Gingles 2-3 requires an assessment of racially polarized voting, which is conducted here using ecological inference techniques that compare cast vote patterns to Census demographics. I find clear evidence that Black, Latino, and Asian voters in the seven county clusters vote cohesively together in statewide general elections, reliably supporting the same candidates of choice. The balance of Texas voters consistently support other candidates, and that has served to block electoral opportunity for the coalition considered here in districts that are mostly White.

Finally, I have found strong indicators that racial considerations predominated over traditional redistricting principles, to the detriment of electoral opportunity, in the construction of twenty-nine districts that are discussed and illustrated individually in my investigation of racial gerrymandering.

References

[1] Amariah Becker, Moon Duchin, Dara Gold, and Sam Hirsch, *Computational Redistricting and the Voting Rights Act*. **Election Law Journal**, Volume 20, Number 4 (2021), 407–441.

[2] Daryl DeFord, Moon Duchin, and Justin Solomon, *Recombination: A family of Markov chains for redistricting.* **Harvard Data Science Review**, Issue 3.1, Winter 2021.

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[4] Karin Knudson, Gabe Schoenbach, and Amariah Becker, *PyEI: A Python package for ecological inference*. **Journal of Open Source Software**, Volume 6, Number 64 (2021), 3397–3401. https://doi.org/10.21105/joss.03397

[5] MGGG Redistricting Lab, *GerryChain Python Library*. GitHub Repository. github.com/mggg/gerrychain

A Constructions of racial and ethnic categories

Total population (TOTPOP) and voting age population (VAP) data are sourced from the 2020 Decennial Census redistricting release (the PL94-171) and are broken down by ethnicity and race according to 126 different categories (63 racial and 2 ethnic choices can be selected by respondents).

With respect to the PL data (TOTPOP and VAP), I have constructed *Black* population as the sum of all categories that include a self-identification as Black (whether Hispanic or not). This is sometimes called *Any-Part-Black* or *Black Alone or in Combination*. I have constructed the *Latino/Hispanic* category with all categories that include a Hispanic ethnic identification, minus those that were already enumerated as Black. Finally, *Asian* (or more fully Asian American Pacific Islander, or AAPI) is built from all categories that include Asian and/or Native Hawaian or Other Pacific Islander responses, minus those already enumerated as Black or Hispanic.

Though the decision about where to place multi-racial respondents is somewhat arbitrary, this system ensures that the sum of Black+Hispanic+Asian includes everyone who selected at least one of Black, Hispanic, Asian, or Native Hawaiian or Other Pacific Islander, no matter the other selections, without double-counting. This sum will constitute the category identified as the *coalition* for the purposes of this report.

Citizen voting age (CVAP) data comes from the 2016–2020 5-Year American Community Survey (ACS) special tabulation. The CVAP data included in the ACS is broken down into a smaller number of sub-categories. The ACS gives Hispanic and Non-Hispanic CVAP estimates, and then further splits Non-Hispanic CVAP into 10 racial sub-categories, rather than the 63 that are available in Decennial Census data. I have reconstructed the racial categories from above with ACS groupings as follows: *Black CVAP* is the sum of the estimates for Non-Hispanic Black Alone CVAP, Non-Hispanic Black and White CVAP, and Non-Hispanic Black and American Indian or Alaska Native CVAP. *Hispanic CVAP* is taken directly from the corresponding ACS count. *Asian CVAP* is the sum of the estimates for Non-Hispanic Asian Alone CVAP, Non-Hispanic Asian and White CVAP, and Non-Hispanic Native Hawaiian or Other Pacific Islander Alone CVAP.

B   Generation of ensembles of districting plans

Ensembles of alternative districting plans were made with the open-source Python package GerryChain, which has been publicly available since 2018 [5].

The basic step begins with a graph representing the geographical units of Texas, then fuses two districts chosen at random. We draw a random tree (graph with no cycles) that spans the double-district; next, the tree is cut at an edge that creates two complementary balanced pieces, which become the new districts replacing the ones that were fused. The district generation process enforces that every district has population within 1% of ideal district size; if the tree has no cut edge leaving sufficiently balanced pieces, then a new tree is drawn. Contiguity is required throughout, as a consequence of the fact that deleting an edge from a tree always leaves two connected components. Compactness is highly favored throughout this process, because compact districts have far more spanning trees [2].

To choose the random tree, a method called *minimum spanning trees* is employed, using weights that encourage county and subdivision integrity. Within-county edges are given a random weight in $[0, 1]$ while those between counties or county subdivisions receive a weight with a +1 "surcharge." This surcharge is additive, so an edge between different counties and between different divisions have a +2, effectively drawing from $[2, 3]$.

The random tree is chosen by drawing weights from these intervals and then finding the (typically unique) spanning tree of minimum weight. In addition, when that tree is cut to separate new districts, the algorithm first seeks for a between-county edge as the cut, if it is possible within balance constraints. This promotes the selection of spanning trees that restrict to counties and municipalities in a single connected piece, which will tend to keep counties and municipalities un-split in the districts. For Congress and Senate, districts were built from VTD (precinct) units as their basic building blocks. For state House, census blocks were employed as the base unit, and a surcharge exactly like the one described above was used to promote the inclusion of whole VTDs.

Convergence diagnostics for this kind of process are performed by varying the starting point and the random number seed, as well as by comparing outputs after 10,000 steps to those after 100,000; comparing outputs with and without filters like county and subdivision preservation; and comparing runs with population deviation thresholded at 1% to alternative runs with 2% or 0.5% leeway. Together, these provided me with high confidence that 100,000 steps is enough in each particular districting setting (Congressional, Senate, and House districts in Texas) to produce stable and reliable statistics. The recombination procedure targets the *spanning tree distribution* on plans. For more information on recombination and convergence heuristics, see especially [2].

I reserve the right to continue to supplement my report in light of additional facts, testimony and/or materials that may come to light. Pursuant to 28 U.S.C. 1746, I declare under penalty of perjury of the laws of the United States that the foregoing is true and correct according to the best of my knowledge, information, and belief.

Executed this 23rd day of May, 2022.

Dr. Moon Duchin